GAS JOURNAL

LIGHT . HEAT . POWER . BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. 203. 85th Year. LONDON, JULY 5, 1933. No. 3659. Price 1s.

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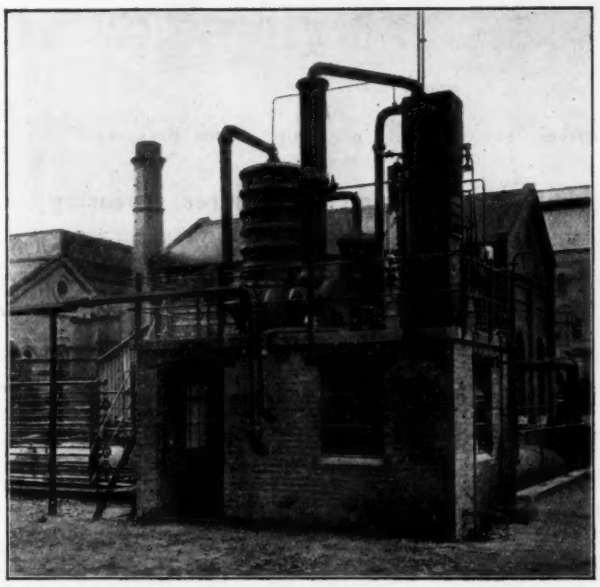

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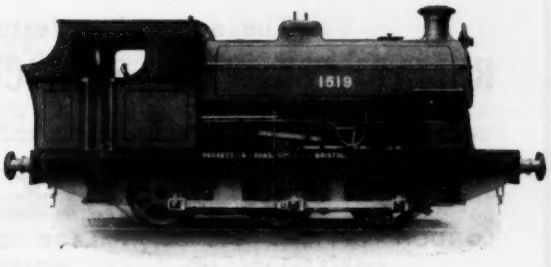
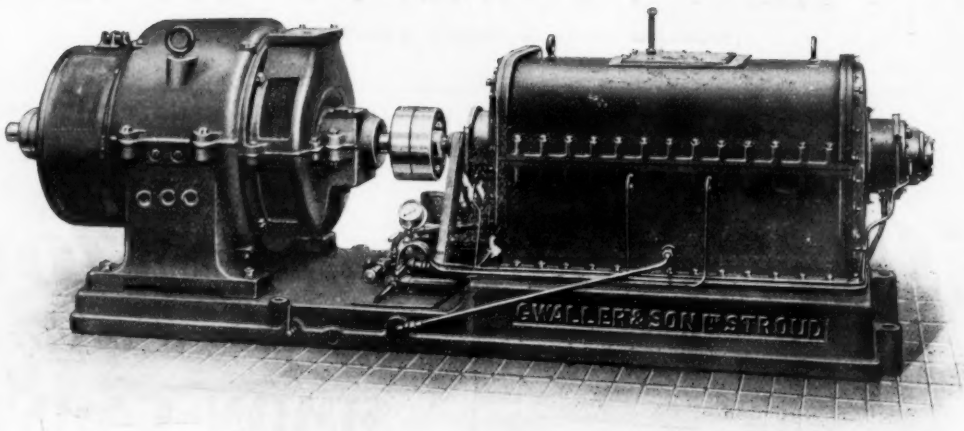


GAS COMPRESSORS



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The CRANKLESS COMPRESSOR embodies distinctive features ensuring minimum frictional losses and very high volumetric efficiency.

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Small space—consequently small building and foundation.
Wide variation of speed and volume.
Constant pressure over wide range of volumes.
High speed and steady discharge.
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Perfect balance and complete absence of vibration.

AN IDEAL TYPE FOR TRANSMITTING COKE OVEN GAS FOR TOWN SUPPLY

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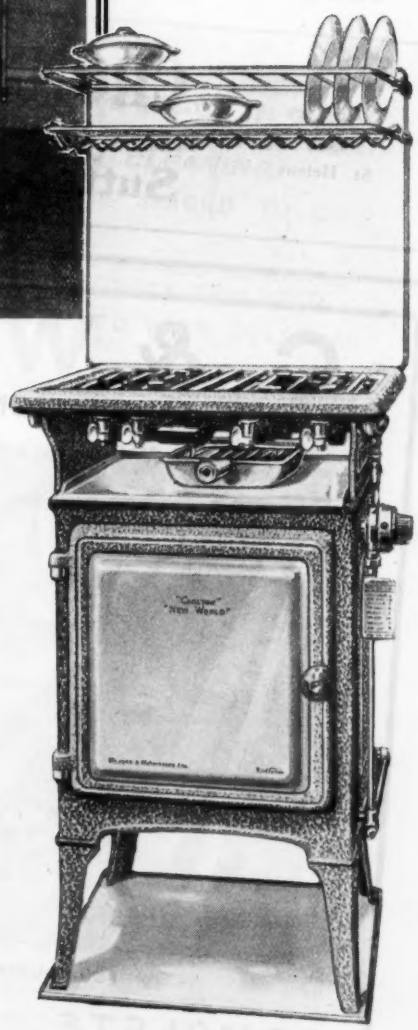

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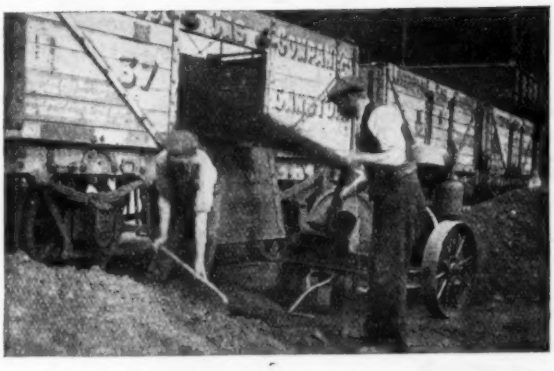

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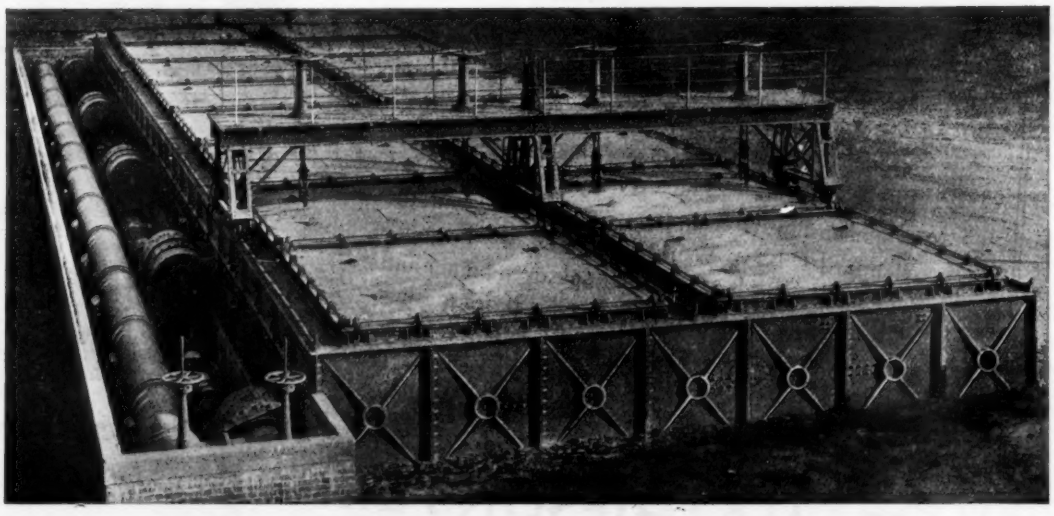

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MAXIMUM COOKING SPACE IN OVEN, WITH *NO PROJECTIONS AND CONSEQUENT EASE IN CLEANING.*

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OVEN AND DOOR LINED WITH CELLULAR ASBESTOS.

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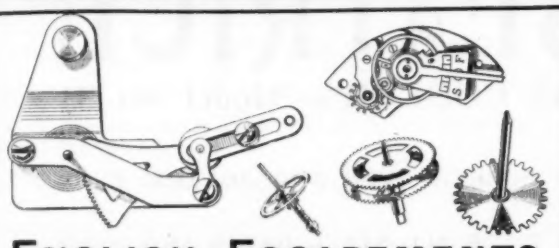

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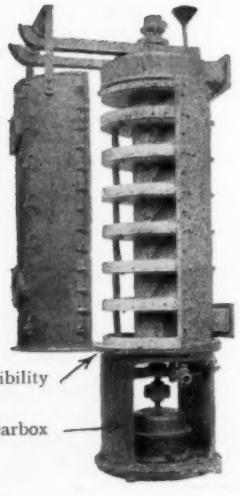
(BRITISH PATENTS 256351 and 256358)

For Small Gasworks

The machines are in use both for the Extraction of Ammonia and Naphthalene, and are most effective for Tar Fog Removal.

Minimum Cost—Maximum Efficiency.



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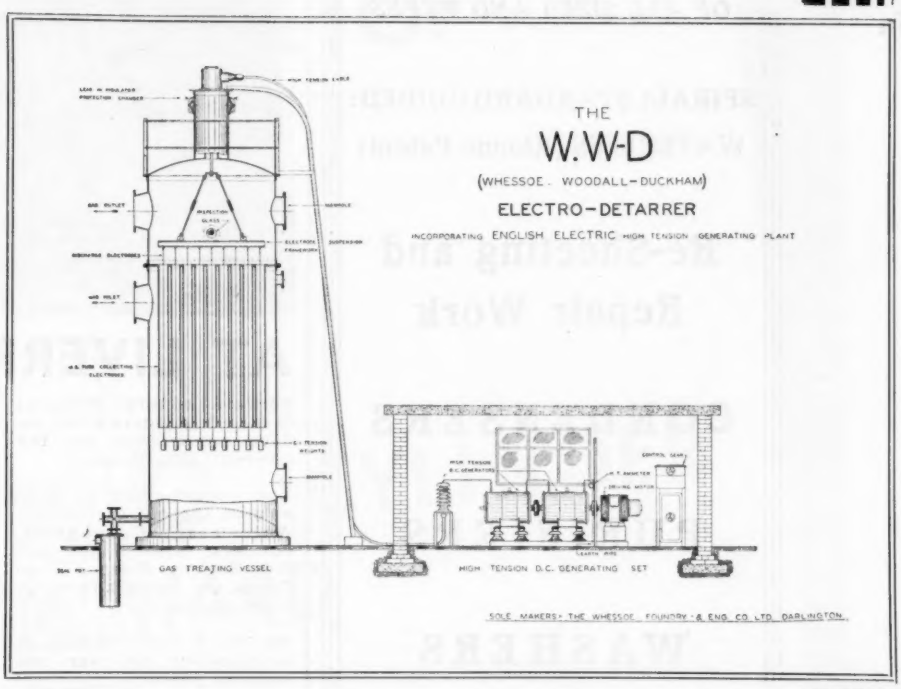

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3. Maximum fog removal efficiency.
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* As supplied to the Nunnery Colliery Co., Ltd., Sheffield, N. E. Webster, Esq., Managing Director.

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PRODUCERS FOR GASIFYING COKE BREEZE

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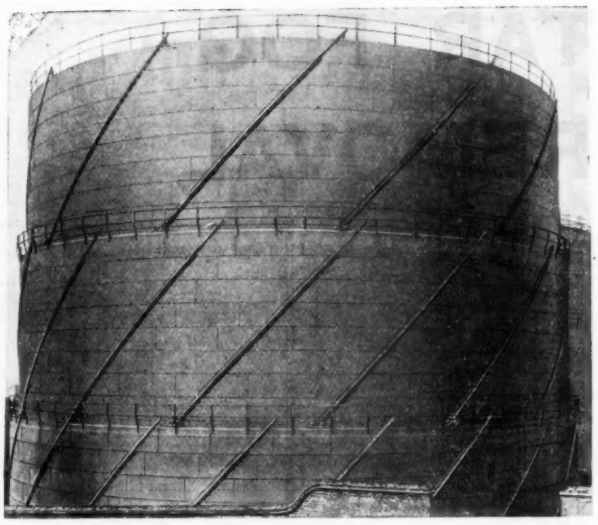

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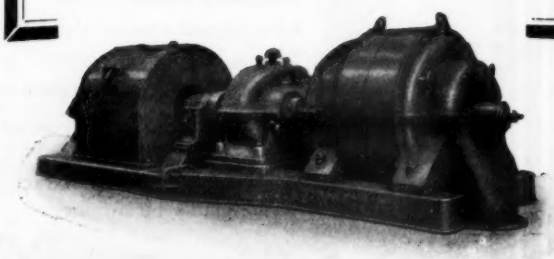
We build a complete range of Compressors & Exhausters for air and GAS, suitable for all purposes connected with the Gas Industry, including Turbo-Compressors for large capacities, as illustrated below.



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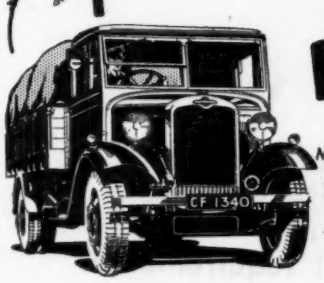

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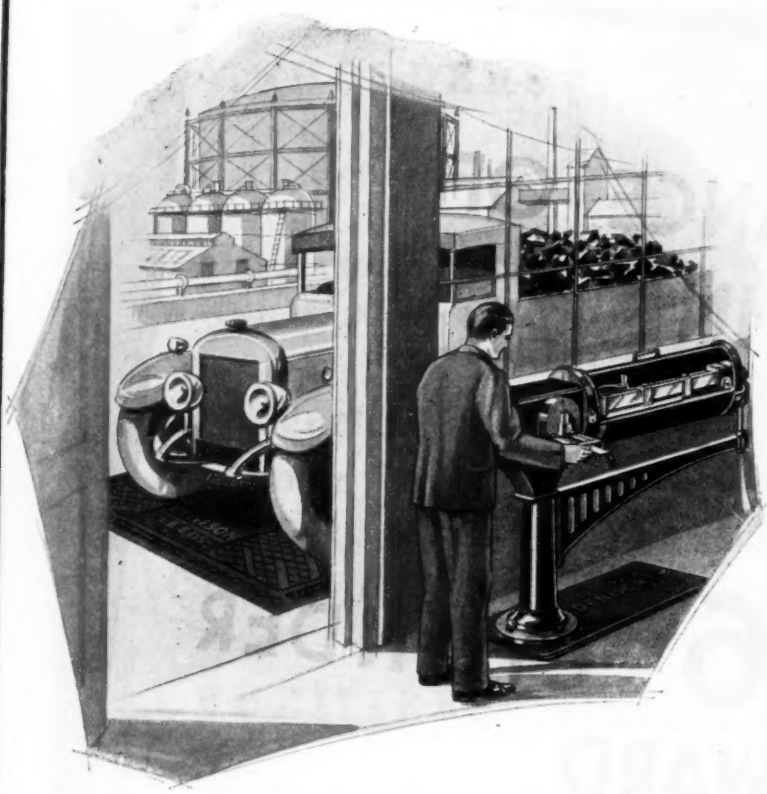

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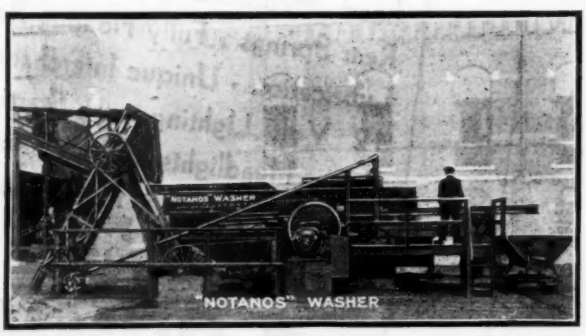

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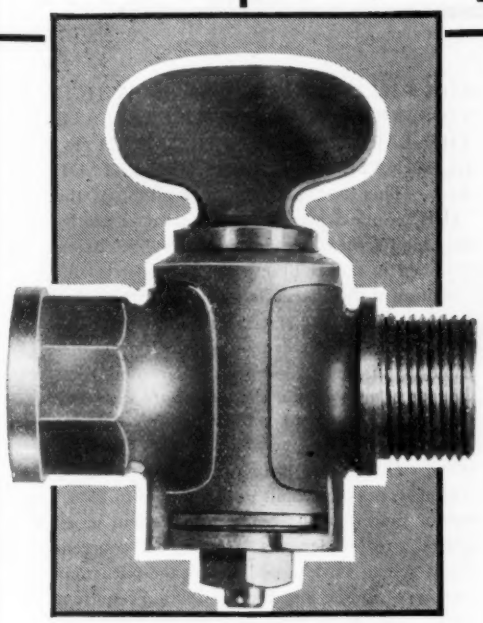

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Always Turns Freely.
Always Sound.

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THE SELF-LUBRICATING FEATURE utilizes the principle of capillary attraction. Consequently oil is fed constantly from a small reservoir in the head of the plug thereby replacing any lost in service.

THE APPLICATION OF THE SPRING LOADING to the plug is carried out in a special manner, which ensures that the plug is always retained on its bearing at a uniform pressure. Dismantling is never necessary.

COCKS FOR ALL PURPOSES can be supplied with these features—Main Service, Gas Fire, Gas Cooker, etc.

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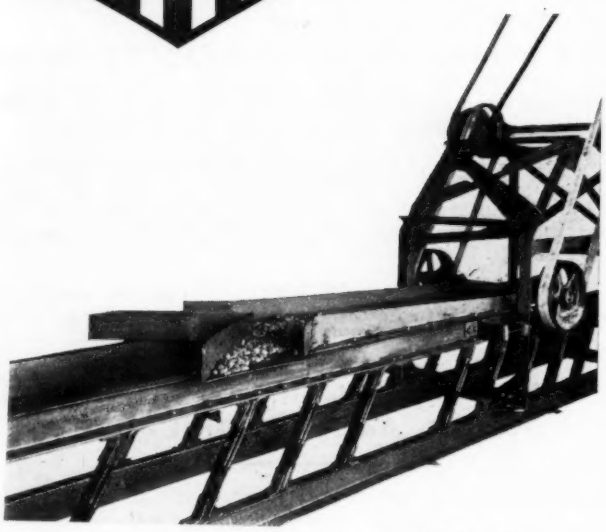

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THE ONLY LOGICAL WAY IN WHICH TO SCREEN COKE IS TO SEPARATE THE LARGER SIZES FIRST AND TO ELIMINATE THE BREEZE LAST OF ALL. This is the method we adopt in the "H.H." Coke Screen, which is characterised by very high screening efficiency, over 95% being obtained in actual practice. The power consumption of this screen is much lower than that required for rotary screens, while the machine acts also as a conveyor, thus facilitating distribution of the graded products into bunkers. ***The only moving part is the shaft carrying the two unbalanced pulleys which actuate the screen,*** there being no cams, rockers, or other complicated parts to get out of order. These screens are built in lengths up to 25 ft., two or more screens being arranged in series where greater lengths are to be covered. Each screen is designed to suit the particular number of grades and the distribution required.

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Think of the time saved! It is automatic Pressure Regulation at its best.

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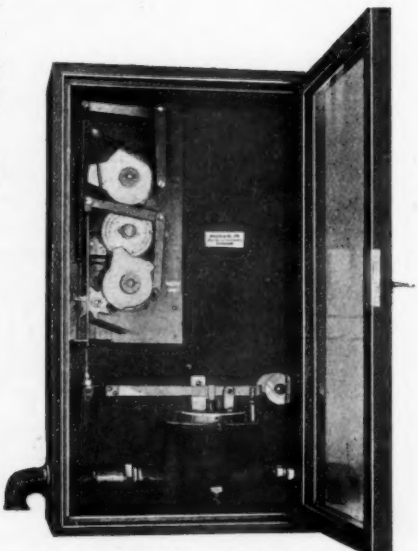

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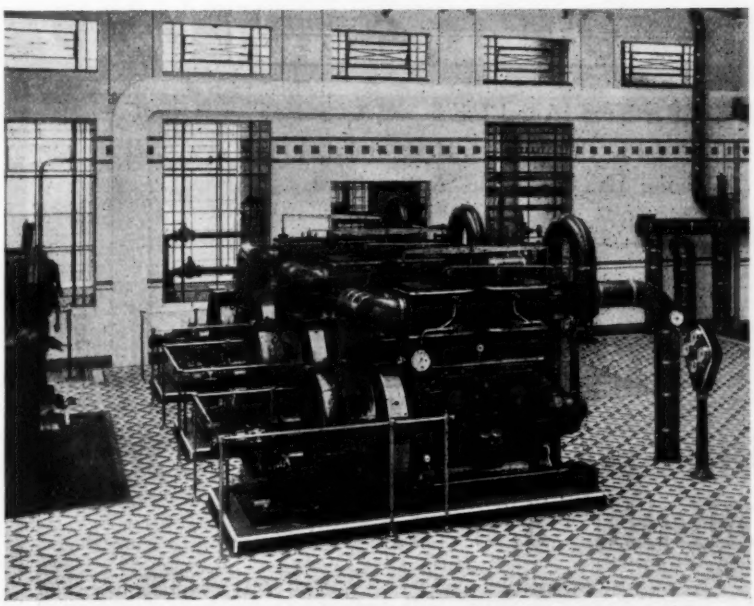

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The large surplus of steam available in modern gas producing installations makes the use of steam engines for all power requirements the most economical proposition.

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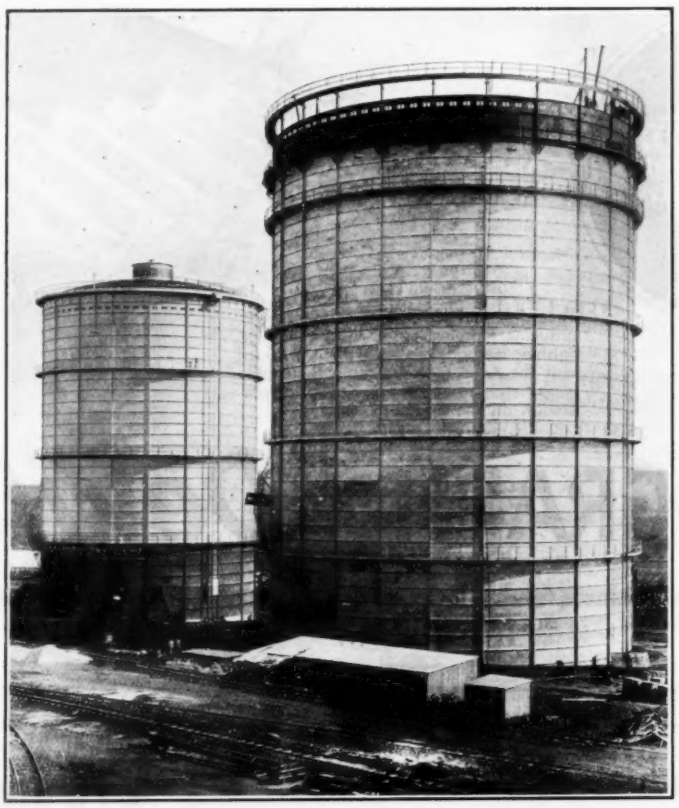

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ASHMORE, BENSON, PEASE, & CO., LTD., Stockton-on-Tees.

NEWTON, CHAMBERS & CO., LTD., Thorncliffe Ironworks, Nr. Sheffield.

THOS. PIGGOTT & CO., LTD., Atlas Works, Spring Hill, Birmingham.

THE HORSELEY BRIDGE & ENGINEERING CO., LTD., Tipton, Staffs.

Dependable in action even under the most arduous conditions, the PEGSON RAMMER is chiefly used for consolidating the back filling of trenches. Not only can the operative control the rapidity with which the blows are delivered, but the weight of each blow can be varied at will.

PEGSON, LTD., COALVILLE, LEICESTER

BRITISH BUILT

Fire!

Are your works and vehicles PROPERLY PROTECTED?

A SPARK may leave your works in flames *to-morrow* . . . an overheated exhaust pipe reduce your valuable lorry to blackened scrap *to-morrow*. Take time by the forelock *to-day*. Equip your works and vehicles with VALOR FIRE EXTINGUISHERS. There's no "perhaps" about VALOR EXTINGUISHERS – they act at once, *killing* the fire effectively and with little effort. Easily handled and understood. Last for years and keep charges undamaged. Illustrated types are only representative of our large range.

Write for List 39V/51, or else visit our Showrooms at Bromford or London.

USED ALL OVER THE WORLD.

The VALOR Co., Ltd.,
Valor Works, Bromford, ERDINGTON, BIRMINGHAM, ENGLAND.

London: 120, *Victoria St., S.W.1.*

Buy British Goods.

E. 320.—Reversible Pattern. In 1, 2 and 3 gallon capacities. Special for export; formula for recharging being shown, saving sending to England for recharges.

Type E. 902.—1 quart size D.A. Pump, suitable for all Motor vehicles and Electrical Establishments. Kills a petrol fire. No risk of electrical shock.

VALOR
FIRE EXTINGUISHERS

E. 12.

CLAYTON SON & Co. Ld., HUNSLET, LEEDS

WELDED STEEL PIPES BEING LAID.

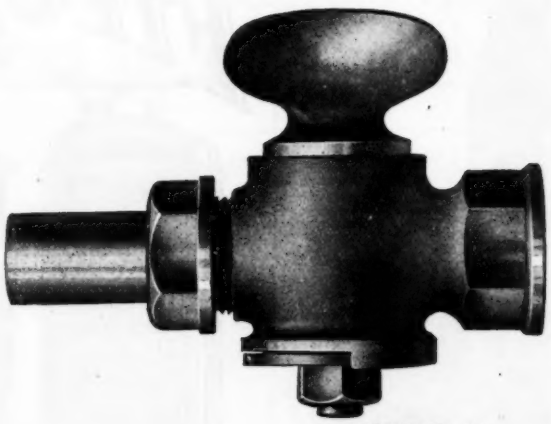
WELDED STEEL PIPES FOR GAS AND WATER

DIAMETERS 16" to 72"
LENGTHS UP TO 25 ft.
CEMENT OR BITUMINOUS LININGS.

LONDON OFFICE:
5, VICTORIA ST.
S.W.1.

INQUIRIES INVITED.

Quality



DESIGN No. 50

GUN-METAL MAIN COCKS

GEORGE ORME & CO.
(Branch of Meters Ltd.)
ATLAS METER WORKS
OLDHAM

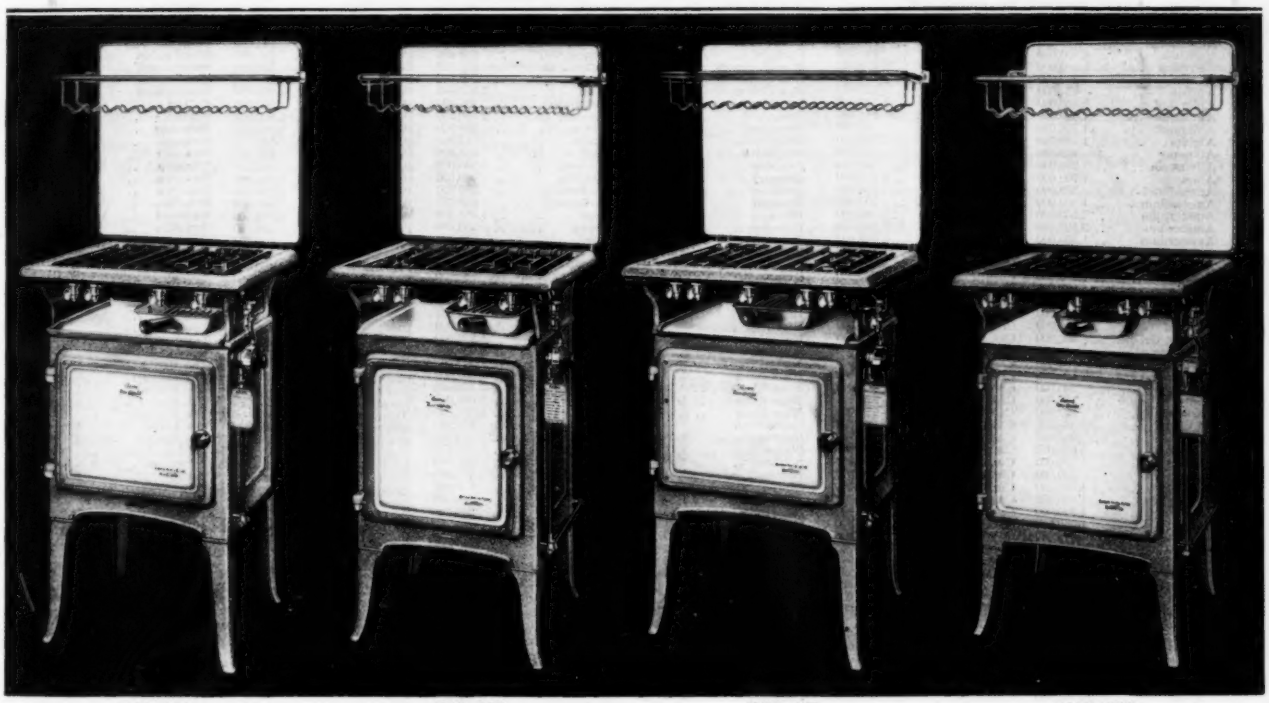
We shall be pleased to receive enquiries for
SAMPLES & PRICES

ENQUIRIES INVITED FOR

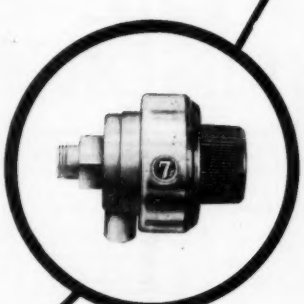
Anglo's GAS OIL

ANGLO-AMERICAN OIL CO. LTD.
36 QUEEN ANNE'S GATE-WESTMINSTER-LONDON-S.W.I.
D.A.128.

4 NEW SIZES



RH 125 RH 325 RH 128 RH 328



The 'Regulo'
(trade mark)

THIS new series of "Acme" "New World" Gas Cookers embodies all the features that have made "Acme" Cookers famous, and all latest improvements.

There are 4 sizes in this series—all with generous oven space to allow several dishes being cooked at the one time. The oven is raised on legs of a suitable height to minimise stooping.

Finished in either "Rado" mottled enamel or the colourful "Beau" enamels, these cookers are right up-to-date—high grade cookers to meet the present-day demand for the best.

"ACME"
"NEW WORLD"
'REGULO'-CONTROLLED
GAS COOKERS

ARDEN HILL & Co. LTD. Radiation

Humphreys & Glasgow Ltd.
Water-Gas

	Cu. Ft. Daily
Aarhus	800,000
Abertillery	500,000
Abertillery	100,000
Admiralty:	
British	4,000,000
French	1,600,000
Agram	200,000
Airdrie	430,000
Aldershot	1,400,000
Aldershot	1,000,000
Aldershot	1,316,000
Algiers	1,760,000
Alkmaar	400,000
Allenstein	200,000
Alost	700,000
Amersfoort	300,000
Amsterdam	1,000,000
Amsterdam	1,000,000
Amsterdam	2,700,000
Amsterdam	1,350,000
Antwerp	1,500,000
Antwerp	1,000,000
Antwerp	1,500,000
Antwerp	1,900,000
Arundel	215,000
Ascot	423,000
Ashford	250,000
Athens, Greece	550,000
Augsburg	425,000
Aylesbury	150,000
Aylesbury	470,000
Banbury	200,000
Banff	125,000
Barmen	500,000
Barnsley	588,000
Barrow	300,000
Barrow	500,000
Barry	500,000
Barry	720,000
Bath	1,000,000
Bath	1,000,000
Bath	1,300,000
Bath	1,200,000
Bedford	1,000,000
Belfast	1,700,000
Belfast	4,500,000
Belfast	1,250,000
Belfast	1,250,000
Belfast	2,250,000
Benrath	125,000
Berkhampstead	259,000
Berlin:	
Charlottenb'g	2,500,000
Danziger Str.	1,600,000
Neukoelln	1,350,000
Schmargendorf	76,000
Tegel	10,095,000
Berne, Switz.	725,000
Bexhill	400,000
Bideford	258,000
Bilston	375,000
Bilston	125,000
Birmingham:	
Adderley St.	675,000
Adderley St.	850,000
Nechells	3,000,000
Nechells	3,000,000
Nechells	3,000,000
Nechells	7,650,000
Swan Village	1,500,000
Windsor St.	3,000,000
Windsor St.	3,000,000
Windsor St.	6,100,000
Bishop's Stortford	200,000
Bishop's Stortford	300,000
Bishop's Stortford	200,000
Bishop's Stortford	300,000
Blackburn	1,190,000
Blantyre	150,000
Blois	125,000
Blois	125,000
Bochum	420,000
Bognor	423,000
Bognor	500,000
Bo'ness	125,000
Bo'ness	250,000
Boulogne	340,000
Bournemouth	1,000,000
Bournemouth	500,000
Bournemouth	1,500,000
Bournemouth	1,000,000
Bournemouth	500,000
Bournemouth	1,530,000
Bournemouth	2,000,000
Bournemouth	500,000
Bournemouth	2,750,000
Bradford	1,250,000
Bremen	550,000
Bremen	950,000
Bremen	850,000
Brentwood	250,000
Brescia	588,000
Brescia	588,000
Brest	550,000
Bridgwater	200,000
Bridlington	150,000
Bridlington	200,000
Bridlington	550,000
Brieg	100,000
Brierley Hill	250,000
Brierley Hill	425,000
Brighton	1,750,000
Brighton	1,850,000
Brighton	750,000
Brighton	2,750,000
Brighton	3,000,000
Bristol	2,000,000
Bristol	2,500,000
Bristol	825,000
Bristol	825,000
Bristol	1,500,000
Bromley	1,500,000
Bruges	200,000
Bruges	600,000
Brussels:	
Anderlecht	350,000
Anderlecht	350,000
Forest	1,000,000
Forest	1,000,000
Forest	1,000,000
Forest	1,500,000
Forest	88,000
Koekelberg	1,000,000
St. Gilles	1,000,000
Brussels:	Cu. Ft. Daily
St. Josse	1,000,000
St. Josse	600,000
St. Josse	775,000
Ville	750,000
Ville	750,000
Ville	1,500,000
Ville	350,000
Bucarest	1,100,000
Buckie	164,000
Budapest	50,000
Budapest	1,750,000
Budapest	200,000
Budapest	250,000
Burnley	1,350,000
Caen	250,000
Cambridge	500,000
Cambridge	1,000,000
Cambridge	1,700,000
Cardiff	2,000,000
Cardiff	3,000,000
Cardiff	1,950,000
Cardiff	600,000
Carlisle	600,000
Carlsruhe	500,000
Carnarvon	248,000
Charleroi	1,250,000
Châteauroux	125,000
Châteauroux	125,000
Châtelet	500,000
Chester	564,000
Chesterfield	430,000
Chesterfield	90,000
Chesterton	197,000
Chichester	250,000
Chorley	300,000
Cie. de Béthune	2,145,000
Cie. des Compteurs	1,150,000
Cie. Lorraine de Ch.	210,000
Cie. Mines de Roche	585,000
Coatbridge	400,000
Commercial, L'n	450,000
Commercial	850,000
Commercial	1,250,000
Commercial	2,000,000
Commercial	800,000
Commercial	2,100,000
Copenhagen	700,000
Copenhagen	2,500,000
Copenhagen	1,750,000
Copenhagen	1,200,000
Courtrai	250,000
Coventry	600,000
Coventry	600,000
Coventry	1,000,000
Coventry	1,250,000
Coventry	350,000
Cowdenbeath	420,000
Cracow	400,000
Cranleigh	188,000
Crefeld	700,000
Crewe	700,000
Crewe	800,000
Crosfield & Sons	1,500,000
Crosfield & Sons	1,500,000
Croydon	1,250,000
Croydon	625,000
Croydon	625,000
Croydon	550,000
Croydon	1,650,000
Croydon	1,125,000
Croydon	150,000
Croydon	3,000,000
Croydon	6,000,000
Deal	250,000
Deal	250,000
Debreczin	100,000
Derby	1,500,000
Derby	2,000,000
Deventer	150,000
Deventer	200,000
Devonport	1,600,000
Devonport	1,100,000
Doncaster	1,350,000
Dorking	150,000
Dorking	300,000
Dorking	130,000
Dover	500,000
Dover	300,000
Dublin	2,000,000
Dublin	2,000,000
Dublin	650,000
Dudley	600,000
Dundee	1,500,000
Dundee	1,650,000
Dundee	900,000
Dunedin, N.Z.	150,000
Dunedin	275,000
Durham	200,000
Dusseldorf	1,000,000
Eastbourne	1,250,000
Eastbourne	1,350,000
Edinburgh	2,000,000
Edinburgh	2,800,000
Eindhoven	1,500,000
Electro-Chimie	650,000
Enschede	282,000
Epping	500,000
Epsom	225,000
Epsom	300,000
Essen	1,400,000
Essen-Borbeck	1,400,000
Exeter	1,700,000
Exeter	1,200,000
Exmouth	376,000
Falmouth	150,000
Falmouth	200,000
Farnham	300,000
Faversham	200,000
Flensburg	300,000
Flensburg	125,000
Folkestone	1,800,000
Fond. del Pignone	164,000
Forst	300,000
Frankenthal	175,000
Fuel Research Wks.	500,000
Fuel Research Wks.	500,000
Gablonz	140,000
Gas L. & C. Co.:	
Beckton	10,000,000
Beckton	7,000,000
Beckton	3,500,000
Beckton	7,000,000
Beckton	7,000,000
Gas L. & C. Co.:	Cu. Ft. Daily
Beckton	5,250,000
Beckton	4,500,000
Beckton	3,000,000
Beckton	1,500,000
Bow Common	1,000,000
Bow Common	1,150,000
Bow Common	150,000
Brentford	1,200,000
Brentford	1,250,000
Brentford	350,000
Brentford	750,000
Brentford	6,000,000
Bromley	3,750,000
Bromley	2,250,000
Bromley	1,000,000
Bromley	1,000,000
Bromley	1,000,000
Bromley	1,450,000
Bromley	1,350,000
Fulham	2,500,000
Fulham	1,700,000
Grays	250,000
Grays	400,000
Grays	725,000
Ilford	650,000
Ilford	750,000
Kensal Green	2,250,000
Kensal Green	2,250,000
Kensal Green	2,250,000
Nine Elms	2,750,000
Nine Elms	750,000
Nine Elms	1,850,000
Nine Elms	2,850,000
Shoreditch	900,000
Shoreditch	2,700,000
Shoreditch	2,725,000
Southall	2,000,000
Southall	3,000,000
Staines	600,000
Stratford	1,700,000
Stratford	850,000
Stratford	2,350,000
Stratford	2,350,000
Gelsenkirchen	525,000
Geneva	500,000
Geneva	700,000
Geneva	1,270,000
Gennevilliers	10,600,000
Gennevilliers	2,900,000
Girvan	235,000
Glasgow	3,000,000
Glasgow	2,500,000
Glasgow	2,250,000
Glossop	340,000
Gloucester	800,000
Gloucester	1,000,000
Gosport	200,000
Gosport	225,000
Goteborg	300,000
Goteborg	600,000
Goteborg	1,000,000
Graudenz	200,000
Groningen, Holland	500,000
Groningen	1,250,000
Guest Keen & P.	1,936,000
Guildford	300,000
Guildford	200,000
Guildford	350,000
Guildford	1,100,000
Guildford	150,000
Haarlem	850,000
Hamburg	1,750,000
Hampton Court	500,000
Hampton Court	600,000
Hampton Court	1,100,000
Hanley	800,000
Hanley	830,000
Hartlepool	750,000
Hartlepool	765,000
Hastings	1,250,000
Haywards Heath	470,000
Haywards Heath	500,000
Hebden Bridge	200,000
Heidelberg	200,000
Hereford	525,000
Hertford	197,000
Hertford	244,000
Hessle	150,000
Heywood	500,000
High Wycombe	752,000
Hilversum	850,000
Hilversum	1,000,000
Hinckley	250,000
Holyhead	197,000
Hong Kong	450,000
Hong Kong	450,000
Hornsey	1,000,000
Hornsey	1,000,000
Hornsey	750,000
Hornsey	750,000
Horsham	235,000
Houillère de Lievin	2,300,000
Hull	1,500,000
Hull	1,000,000
Hull	1,600,000
Innsbruck	200,000
Ipswich	750,000
Ipswich	1,250,000
Ipswich	600,000
Jersey	564,000
Jersey	564,000
Kampen	350,000
Karlshad	350,000
Kendal	329,000
Kidsgrove	235,000
Kiel	1,000,000
Kiel	880,000
Kilmarnock	500,000
Kilmarnock	585,000
King's Lynn	197,000
King's Lynn	400,000
Kingston-on-Th	3,400,000
Kirkintilloch	360,000
Kirkintilloch	827,000
Kolozvar	100,000
Lancaster	500,000
Langley Mill	500,000
Largs	235,000
Lausanne	250,000
Lausanne	385,000
Lausanne	970,000
Lea Bridge	350,000
Lea Bridge	350,000
Lea Bridge	Cu. Ft. Daily 400,000
Lea Bridge	1,000,000
Lea Bridge	1,500,000
Lea Bridge	1,530,000
Leamington	600,000
Leamington	525,000
Leatherhead	705,000
Leeds	1,500,000
Leeuwarden	400,000
Leicester	2,700,000
Leiden	500,000
Leiden	575,000
Leigh	350,000
Lemberg	260,000
Lemberg	500,000
Letchworth	362,000
Letchworth	423,000
Liege	1,000,000
Liege	750,000
Lille	860,000
Lincoln	500,000
Lincoln	893,000
Littlehampton	500,000
Liverpool	3,500,000
Liverpool	4,500,000
Liverpool	750,000
Liverpool	1,750,000
Liverpool	1,250,000
Liverpool	3,000,000
Liverpool	1,500,000
Liverpool	1,250,000
Liverpool	2,350,000
Liverpool	3,000,000
Liverpool	8,600,000
Long Eaton	430,000
Long Eaton	170,000
Longton	500,000
Louvain	800,000
Lubeck	400,000
Luton	400,000
Luton	300,000
Maastricht	200,000
Macclesfield	800,000
Magdeburg	1,400,000
Maidenhead	225,000
Maidenhead	225,000
Maidenhead	175,000
Maidenhead	175,000
Maidenhead	200,000
Maidenhead	200,000
Maidstone	500,000
Maidstone	500,000
Malines	500,000
Malines	575,000
Malmo	350,000
Malta	400,000
Manchester	3,500,000
Manchester	3,500,000
Manchester	1,500,000
Mansfield	330,000
Mansfield	493,000
Margate	960,000
Marlborough	150,000
Mayence	700,000
Melbourne	5,000,000
Merthyr Tydfil	300,000
Merthyr Tydfil	200,000
Middlesbrough	1,250,000
Middlesbrough	750,000
Middlesbrough	900,000
M.M. Woolston	9,000,000
Minehead	300,000
Monaco	275,000
Monaco	618,000
Monaco	618,000
Monaco	400,000
Complete Gasification	
Mons	500,000
Montevideo	1,222,000
Morecambe	333,000
Moscow	1,000,000
Munich	1,400,000
Namur	175,000
Narbonne	350,000
Nelson	400,000
Nelson	350,000
Neuchâtel, Switz.	250,000
Neuss	140,000
Newbury	250,000
Newcastle	2,500,000
Newcastle, N.S.W.	500,000
Newhaven	235,000
Newport Pagnell	188,000
Nice	900,000
Nice	1,295,000
Nictheroy	250,000
Nimes	420,000
North Middlesex	200,000
North Middlesex	200,000
North Middlesex	1,000,000
North Middlesex	1,600,000
North Middlesex	800,000
Complete Gasification	
North Middlesex	900,000
2nd Complete Gasification	
North Sydney	500,000
North Sydney	500,000
Norwich	1,500,000
Norwich	300,000
Norwich	500,000
Norwich	1,500,000
Nottingham	1,000,000
Nottingham	1,000,000
Nuneaton	125,000
Oberhausen	175,000
Oldbury	500,000
Oldenburg	200,000
Ormskirk	170,000
Ostend	100,000
Ostend	200,000
,, Zandvoorde	700,000
Oxford	4,500,000
Palermo	968,000
Palermo	850,000
Paris:	
Clichy	4,000,000
Ivry	2,355,000
Landy	6,000,000
Landy	6,000,000
Landy	5,295,000
La Villette	4,000,000
La Villette	2,000,000
La Villette	2,000,000
Paris-Plage	125,000
Pau	550,000
Pavie	194,000
Pavie	212,000
Pembroke	240,000
Perigueux	350,000
Perth, W.A.	125,000
Perth, W.A.	1,000,000
Petone, N.Z.	200,000
Piggott & Co.	1,500,000
Plymouth	2,000,000
Poitiers	350,000
Pontypool	120,000
Port Elizabeth	400,000
Portsmouth	1,000,000
Portsmouth	2,000,000
Portsmouth	800,000
Portsmouth	2,000,000
Posen	450,000
Posen	700,000
Prague	140,000
Preston	1,400,000
Ramsgate	430,000
Reading	1,000,000
Reading	1,000,000
Reading	600,000
Redditch	500,000
Redhill	275,000
Redhill	300,000
Redhill	1,100,000
Redhill	625,000
Reichenberg	400,000
Reval	350,000
Rhymney	175,000
Rhymney	250,000
Riddings	258,000
Ripley	120,000
Rochester	2,200,000
Rochester	2,800,000
Romford	300,000
Romford	350,000
Romford	1,200,000
Rotterdam	850,000
Rotterdam	1,500,000
Rotterdam	750,000
Rotterdam	750,000
Rotterdam	600,000
Rotterdam	2,000,000
Rotterdam	500,000
Roulers, Belgium	250,000
Royston (Yorks.)	250,000
Rugby	1,000,000
Rugby	450,000
Rushden	425,000
Rushden	517,000
Rushden	225,000
Ryde	600,000
Ryde	600,000
Saffron Walden	235,000
St. Albans	700,000
St. Albans	580,000
St. Albans	1,500,000
St. Andrews	210,000
St. Andrews	409,000
St. Gallen	225,000
St. Gallen	225,000
St. Nicolas, Belgium	250,000
Sté. Ch.Gr. Paroisse	1,320,000
Sté.Ch.Gr Paroisse	2,900,000
Sté. I. & F. de Lens	1,130,000
Sté. I. & F. de Lens	1,130,000
Sté. Kuhlmann	1,285,000
Sté. Kuhlmann	3,200,000
Sté. Kuhlmann	2,150,000
Sté. Kuhlmann	3,830,000
Sté. Tubes Meuse	545,000
San Paulo	700,000
Scarborough	800,000
Scarborough	200,000
Scarborough	350,000
Scarborough	1,300,000
Scarborough	1,350,000
Seaford	200,000
Shanghai	225,000
Shanghai	225,000
Shanghai	1,600,000
Shanghai	2,200,000
Shanklin	259,000
Shanklin	400,000
Sheerness	200,000
Sheerness	180,000
Sheerness	200,000
Sheerness	220,000
Sheffield	1,530,000
Sheffield	3,000,000
,, Steel Prods.	3,000,000
Shirebrook	500,000
Shrewsbury	300,000
Shrewsbury	170,000
Sidmouth	225,000
Singapore	600,000
Sittingbourne	259,000
Southampton	900,000
Southampton	500,000
Southampton	600,000
Southampton	100,000
Southampton	1,000,000
Southampton	1,450,000
Southend	1,250,000
Southend	900,000
Southend	900,000
Southend	600,000
Southgate	400,000
Southgate	500,000
Southgate	800,000
Southgate	500,000
Southport	750,000
Southport	900,000
Southport	900,000
Southport	450,000
South Shields	650,000
South Shields	1,250,000
Stafford	500,000
Stafford	750,000
Stettin	880,000
Steyning	150,000
Stirling	400,000
Stirling	970,000
Stockholm	1,500,000
Stockholm	1,750,000
Stockport	600,000
Stockport	600,000
Stockport	400,000
Stockport	Cu. Ft. Daily 400,000
Stockton	500,000
Stockton	250,000
Stourbridge	500,000
Stourbridge	500,000
Sunderland	2,250,000
Sunderland	300,000
Sunderland	475,000
Sutton	1,269,000
Sutton	1,625,000
Swanage	300,000
Swansea	750,000
Swansea	1,000,000
Swansea	450,000
Swansea	1,250,000
Swansea	2,000,000
Swindon	300,000
Swindon	450,000
Swindon	400,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	8,250,000
Sydney	2,750,000
Taunton	225,000
Taunton	350,000
Tawe Valley	275,000
Teignmouth	200,000
The Hague	1,000,000
The Hague	500,000
The Hague	1,750,000
The Hague	1,500,000
The Hague	775,000
The Hague	1,500,000
The Hague	2,930,000
Tilburg	400,000
Tirlemont	120,000
Tokyo	2,000,000
Torquay	350,000
Torquay	350,000
Torquay	320,000
Tottenham	750,000
Tottenham	750,000
Tottenham	350,000
Tottenham	1,000,000
Tottenham	1,000,000
Tottenham	1,250,000
Tottenham	2,500,000
Tottenham	1,000,000
Tottenham	500,000
Tottenham	1,000,000
Toulouse	1,800,000
Toulouse	785,000
ToulouseNatl Wks.	2,400,000
ToulouseNatl Wks.	6,200,000
ToulouseNatl Wks.	3,730,000
Tournai	700,000
Tours	550,000
Trowbridge	250,000
Trowbridge	150,000
Tunbridge Wells	1,000,000
Tunbridge Wells	1,000,000
Tunis	175,000
Tynemouth	1,100,000
Tynemouth	1,100,000
Ulm	400,000
Union Chim.-Belge	1,977,000
Utrecht	1,000,000
Utrecht	1,000,000
Uxbridge	752,000
Uxbridge	1,000,000
Vancouver	3,800,000
Verviers	1,000,000
Vevey, Switz.	650,000
Victoria, B.C.	500,000
Vienna	3,500,000
Vienna	2,500,000
Walsall	750,000
Walsall	375,000
Waltham	400,000
Waltham	140,000
Walton-on-Thames	970,000
Wandsbek	125,000
Wandsworth	1,800,000
Wandsworth	4,230,000
Wanganui, N.Z.	376,000
Ware	150,000
Ware	282,000
Warwick	125,000
Wasmuel	500,000
Watford	500,000
Watford	350,000
Watford	400,000
Watford	1,250,000
Wath	430,000
Weimar	100,000
Wellingborough	525,000
Wellingborough	525,000
Wellingborough	550,000
Wellington, N.Z.	350,000
Wellington	300,000
West Bromwich	550,000
Westgate	250,000
Weston-Mare	350,000
Weston-Mare	350,000
Weston-Mare	150,000
Weston-Mare	150,000
Weston-Mare	500,000
Wexford	100,000
Weymouth	400,000
Weymouth	100,000
Weymouth	658,000
Whitstable	423,000
Widnes	500,000
Wiesbaden	850,000
Wigston	250,000
Winchester	225,000
Winchester	125,000
Winchester	410,000
Winchester	325,000
Woking	400,000
Wolverhampton	1,500,000
Wolverhampton	1,000,000
Wolverhampton	250,000
Wolverhampton	400,000
Worthing	525,000
Yarmouth	500,000
Yarmouth	125,000
Yeovil	340,000
Zwolle	200,000
Zwolle	200,000
Zwolle	700,000

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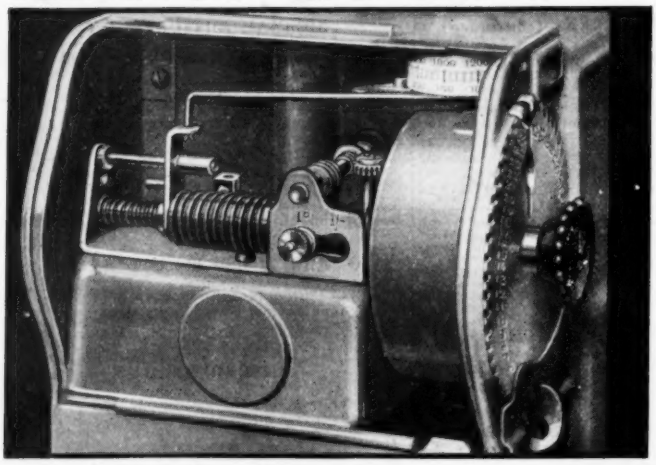

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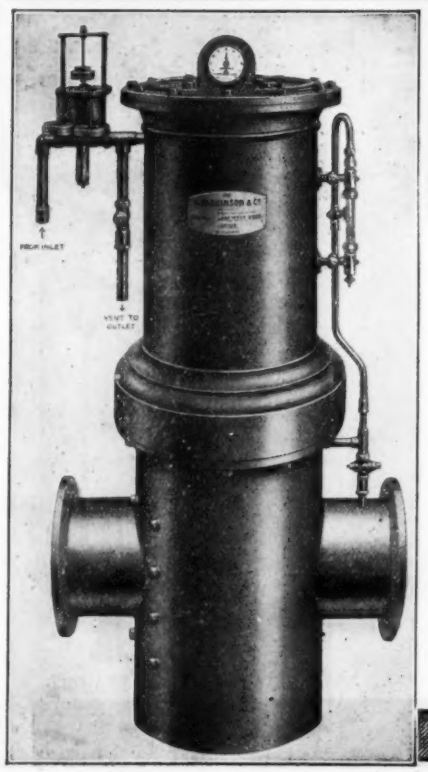

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THE GAS JOURNAL

JULY 5, 1933

Vol. 203. 85th Year No. 3659

A NEW FEATURE.

To meet the expressed views of a number of both "buyers" and "sellers" within the Industry, we are publishing, as a Supplement to this issue of the "JOURNAL," an Index and Buyers' Guide to the June Advertisements. It is yet a further step towards the goal of complete service at which we aim, and which was brought nearer only last week by the new postal wrapping adopted.

Our hope is that this new approach will be welcomed by the wide and varied circle of friends with whose interests we are identified.

A Glance at the Contents—

Development of Gas Supply in Lincoln.

Details are published to-day of the past history of the Lincoln Gas Undertaking, together with particulars of the new retort installation and ancillary plant just completed. [p. 29.]

A Hundred Years' Service at Hastings.

In connection with the centenary of the Hastings and St. Leonards Gas Company, celebrated last year, Mr. C. F. Botley, the Engineer and General Manager, has compiled a booklet dealing with the history of the Company, from which extracts are taken. [p. 49.]

Pyrometric Economies.

Mr. W. Bowen, a member of the Faraday Society, describes a new thermocouple—called the "Pyrofer"—which possesses extraordinary heat-resisting properties, and which, when immersed without protection in a lead bath raised to 1350° or 1400° C., showed not the slightest sign of deterioration after some hours of heating. [p. 48.]

Hydrogen Sulphide Removal.

Concluded to-day is the contribution on the design of purifiers for the removal of hydrogen sulphide from town gas by means of iron oxide. [p. 51.]

I.G.E. Written Communications and Replies.

The written contributions to the discussions on the papers read at the recent Liverpool meeting of the Institution of Gas Engineers, together with the authors' replies, are published. [p. 35.]

Posts Vacant.

A Gas Company in the Midlands is advertising for an Engineer and Manager. [p. 58.]

A Corporation is inviting applications for the post of Gas Engineer and Manager, the commencing salary offered being £600 per annum. [p. 58.]

A Borough in delightful country invites applications for the post of Engineer and Manager of the Gas and Water Works, the commencing salary being £300 a year. [p. 58.]

Forthcoming Engagements

July 10.—I.G.E.—Meetings of Finance Sub-Committee, 2 p.m.; Finance Committee, 2.30 p.m.; Executive Committee of the Council, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.

July 11.—I.G.E.—Meeting of Council, 10 a.m.

July 11.—FEDERATION OF GAS EMPLOYERS.—Meeting of Central Committee, 12 noon, 28, Grosvenor Gardens, S.W. 1.

July 11.—N.G.C.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1.

July 12.—I.G.E.—Meeting of General Research Committee, 10 a.m.

July 19.—B.C.G.A.—Meeting of Executive Committee, 28, Grosvenor Gardens, S.W. 1, 12 noon.

July 20.—S.B.G.I.—Council Meeting at 2.30 p.m.

July 21.—MANCHESTER DISTRICT ASSOCIATION.—Visit to the Higginshaw Gas-Works, Oldham. Paper by Mr. Norman Hudson, Mirfield—"Observations on the Differential Charges of Gas for Distribution Purposes."

July 24.—I.G.E.—Meeting of Liquor Effluents and Ammonia Sub-Committee.

July 25.—I.G.E.—Meetings of Joint Research Committee, 10.30 a.m.; General Research Committee, 2.30 p.m.

Sept. 7.—NORTH BRITISH ASSOCIATION.—Annual Meeting in Paisley.

Sept. 21.—WALES AND MONMOUTHSHIRE ASSOCIATION.—Meeting at Porthcawl.

Nov. 7-8.—I.G.E.—Autumn Research Meeting.

1933 "JOURNAL" Directory.

Page 38. KNOWLE. F. J. Ward, Engineer, Manager, and Secretary, deceased.

Page 42. LOWESTOFT. J. L. Jennings, Accountant, appointed to Bristol.

EDITORIAL NOTES

Co-Operation

THE reception which was given to the paper on the application of gas to industrial processes which Mr. J. E. White, of Newcastle, presented at the annual meeting of the Institution of Gas Engineers last June is significant of the widespread interest which has been aroused in this phase of our Industry's activities, and of the growing appreciation of the enormous potentialities of gaseous fuel in the industrial field. The verbal discussion had as its keynote the proved advantages of co-operation in securing the business for gas and the urgent need for extended co-operative effort; and this need is emphasized further in the written communications on the paper which we publish to-day together with the author's reply. The written communications are of great value also because they bring out so clearly four major factors influencing the development of the industrial load. First, there is the question of price; and we are in complete agreement with Mr. Clegg, of Burnley, that some form of multi-part charge is a necessity if we are to meet successfully competition in the industrial and commercial gas business. Block charges based on quantity do not meet the varying conditions of particular types of load. Secondly, however valuable demonstration rooms are, they are no substitute for demonstrations of the possibilities of gas on the works of would-be consumers. Thirdly, gas will not progress unless the salesman has a thorough understanding of the actual processes which the potential consumers have in operation. Then we have the evidence of what research work is likely to accomplish in furthering the application of gas by industrialists.

The remarks of Mr. Mackay, of Stoke-on-Trent, who has done so much excellent work in regard to the use of town gas in the pottery trades during recent years, explain the reasons for his success and once again demonstrate that all-in cost per unit of work produced should be the line of attack in the approach to the industrialist —not first fuel cost. For pottery firing, gas possesses many advantages; and in one factory coal-firing costs amounted to $7\frac{1}{2}\%$ of the selling price of the goods made. Since the introduction of town gas the firing costs have been reduced to $4\frac{1}{2}$-5%. Apart from fuel costs, the time taken in executing orders has been greatly reduced. Pottery goods are not as a rule made for stock. Much may therefore depend on the speed with which a batch of goods ordered may be made and dispatched. To-day, by gas, an order for goods can be completed in three days, while formerly up to fourteen days was frequently taken to execute a similar order. Heat-control is becoming more and more a necessity in modern manufacturing processes; and in this connection Mr. Mackay describes briefly a new tunnel furnace for heating pottery ware. So confident is he of the success of this furnace that he has decided to install one at any factory the Pottery Association may determine, the cost to be shared by the Stoke-on-Trent Gas Department and the builder of the oven. This type of enterprise is what is needed; and it is enterprise which owes its birth to a close study of the requirements of the customer by the Gas Department—familiarity with the nature of the materials to be fired, and with the different glazes and decorations. The experimental work was carried out in a properly equipped demonstration room set up by the Department, but there is no doubt whatever that Mr. Mackay is right in building an experimental firing tunnel in a factory, because the manufacturer likes to see gas doing his work in surroundings which are natural to him.

As for research, the work which has been undertaken at Leeds University and also by the Sheffield Gas Company in an endeavour to overcome the difficulty arising out of scale formation on steel stands out for comment, for the results will go far towards placing gas in a position vastly superior to that of any of its competitors. As Mr. White mentions, it is a common claim by industrial salesmen that there is " practically no scale " with the use of gaseous fuel. While, he remarks, this expression is to a very large extent true—truer, in fact, in the case of gas than any other fuel—it is not quite good enough for many of the exacting metallurgical problems which are met with in almost everyday practice. The efforts, therefore, which are being made to overcome this difficulty are of the greatest value to the Industry; and the time is not far distant when it will be possible to offer without reservations gas as a non-scaling fuel.

The way in which the Industry is setting out to gain industrial business is most encouraging, and there never was a more opportune time for advancing the claims of an all-British smokeless fuel. Industrialists are more prepared than ever to listen to the Gas Industry's claims and to try out these claims in practice; and it is a sign of awaking to the merits of a home-produced fuel that the Minister of Transport has put the passenger-carrying coal gas vehicle on the same footing as to taxation as the steam vehicle. This move should act as a fillip to experimental work on the use of gas not only for transport but in the internal combustion engine generally—a field which appears to offer much promise. In this direction, as in all others, co-operation is essential to speedy development.

The Hopeful View

ON another page of this issue of the " JOURNAL " will be found a letter which urges the encouragement of local schemes of development. " Tradesmen," says our correspondent, " whatever their line of business, want to see local spending power increased. The building of," he instances, " a new bridge means increased spending power in the territory on which they depend for their custom. Therefore, with all the power at their command, they ought to encourage local schemes of development. They are not doing it. Unwisely, in their own interests as in the interests of the nation, they have accepted the economy call, and, believing that enterprise by Local Authorities is somehow or other detrimental to their business, they have succeeded in stopping many of the projects which would have added materially to their own prosperity, as well as increasing the wealth of the community." In one aspect or another, the matter which our correspondent raises has been many times referred to in our pages, but constructive criticism such as that which he advances is always welcome—particularly when it relates to a subject of vital interest to the nation at large.

Little more than a month ago, under the heading of " Beacons of Hope," we devoted our first leader to a " message from Lancashire," which, we said, might well be taken to heart by the Gas Industry. To-day it is our great pleasure to report a similar " message from Lincoln." Even though we may admit the sound reason for some part of the shaking of heads which of late has been so frequently met with, still there remains much to gladden our hearts in the two messages here referred to. They bid us rejoice that the Industry with which we are bound up can produce, during a time of unprecedented difficulty, such examples of Corporation enterprise—such proof of steadfast faith in the future—as the messages provide. We pointed out in our issue of May 31 that in times of industrial depression one could take either of two courses—classing these as the " static " course and the " dynamic " course. The latter course was explained as being " to examine the causes of the depression, to re-adjust weaknesses, to pursue new fields of work, and to prepare so as to be in the forefront of any turn in the tide of trade." Of the two examples from Lancashire, one was that of the Corporation of Oldham, whose Higginshaw Gas-Works have been reconstructed, as the first stage of the Gas Committee's policy of centralizing the production at this works. The new works provide a modern plant, and the lay-out is on lines capable of economical extension in the future. The gas undertaking at Oldham possesses a long record of public service, and it has now, by the example it has set, added substantially to this service. " Can the average citizen imagine what this country

would be like without gas? " asked H.R.H. Prince George, when performing the opening ceremony. We do not believe the average citizen can imagine any such state of affairs; neither do we think that he will ever have to realize it.

Lincoln's Enterprise

LEAVING Oldham, we can now turn to Lincoln, whose good example is dealt with, by word and picture, in the body of this number of the "JOURNAL." The Corporation of Lincoln, through their gas undertaking, have accomplished two things—demonstrated their sturdy faith in the future of the Industry, and substantially relieved the local problem of unemployment, for much of the new plant has been made in the city, whose activities are largely in this direction, while a large number of local men have also been employed on the site. The scheme includes not only a new Woodall-Duckham retort installation, but a large quantity of ancillary plant by Messrs. Newton, Chambers, & Co., Ltd., together with other apparatus by Messrs. W. C. Holmes & Co., Ltd., and Messrs. Peebles & Co. In addition, there was completed not very long ago a spiral-guided holder by Messrs. Newton, Chambers, & Co., from which was taken the view of the works that will be seen at the commencement of our descriptive article to-day. Work began actively in the middle of January last year, and the major part of the scheme was completed in ten months—which is rightly regarded as a tribute to the efficiency of the specifications and drawings made by the City Gas Engineer and Manager, Mr. George Wright, A.M.I.Mech.E.

The opening of the reconstructed Bracebridge Gas-Works at Lincoln was also notable for the presence of Mr. Ernest Brown, M.P., Minister of Mines, who performed the ceremony, and greatly pleased his large audience by his sympathetic attitude towards the Gas Industry. It is recognized by Mr. Brown that one of the industries upon which the Minister of Mines is bound to keep a kindly eye is the Gas Industry; and he believes that gas and coal have a very great future. Further, Mr. Brown thinks it is time that someone put up a fight for the country's native energy. The peculiar circumstances of this country render it of the utmost importance, if we want to hold our own in the markets of the world, that we should make the best and most scientific use of the coal at our disposal. We believe that there can be no more scientific use of our coal than by carbonization at a gas-works, and that Mr. Brown visualizes the trend of events is apparent from his remark that " as manufacturers realize more clearly the immense possibilities of gaseous fuel for industrial processes requiring heat, there will be a vast extension of the industrial sales of gas, with a consequent increase in the amount of coal purchased by the undertakings." All this, with what he had to say about the oil tax, assures us that the Gas Industry has a good friend in Mr. Brown, and we cordially support Mr. F. P. Tarratt, who, speaking as President of the Institution of Gas Engineers during the inauguration proceedings, expressed the greatest feelings of admiration for Mr. Brown's broad and enlightened outlook.

Vapour-Phase Gum

A SHORT time ago we published an extract from a paper on " The Gum Problem in Town Gas " which Mr. W. H. Fulweiler presented at the annual convention of the American Gas Association last year. This important paper, which embodied the findings of twelve years' study of the problem, made it clear that there are two types of gum which may be found in town gas. One is " liquid-phase gum," formed by the polymerization and oxidation of unsaturated hydrocarbons, primarily styrene and indene, which can be removed from the gas by oil washing. The other is " vapour-phase gum," which presents an entirely different problem. This gum is dispersed in the gas in the form of very fine particles, and its formation is due to the reaction of several hydrocarbons with oxides of nitrogen, the major source of the latter being the oxides of nitrogen in the products of combustion in the settings surrounding the retorts. This gum, too, can be removed, but details are not yet available as to the method and plant employed.

While these two types of gum are thus distinct in their modes of formation, they do not differ sufficiently for purposes of identification in more than a few of their properties and reactions. Vapour-phase gums have a nitrogen content of 3% or more; they are soluble in dilute alkalis, and insoluble, or nearly so, in tetralin; they harden somewhat more rapidly on exposure than do liquid-phase gums; and they have a marked tendency towards sudden decomposition on heating. The positive identification of a particular deposit on the basis of these properties, however, has frequently been rather difficult and in some cases quite impossible. Both types vary widely in appearance and physical character, either may be deposited in admixture with a wide variety of extraneous materials, liquid or solid, and in many cases the amounts available are too small to permit thorough examination.

When decomposed by heat, the vapour-phase gums give up their nitrogen in the form of oxides; and this is the basis of a simple test devised by the Koppers Research Corporation and described by Mr. R. N. Wenzel in the *Gas Age-Record* (April 22, 1933). This qualitative test, which is highly sensitive, depends on the action of nitrogen dioxide on starch-potassium iodide paper; and it can be used to detect the presence of vapour-phase gum and to distinguish it from all other types of resinous deposits. Mixing a sample of vapour-phase gum with abundant amounts of naphthalene, sodium cyanide, or sodium thiocyanate, does not interfere with the test; and the Koppers Research Corporation feel confident that the test will prove extremely useful in the study of gum problems in the field. It is easily and quickly carried out; requires neither special apparatus nor expensive reagents; does not require larger samples than are readily obtainable where gum problems are acute; and it distinguishes sharply between vapour-phase gums and all other deposits found in distribution systems but not formed by the addition of nitrogen dioxide to unsaturated compounds.

Control of Statutory Undertakings

READERS will be interested to note that Mr. William Cash, F.C.A., is to read a paper before the International Congress on Accounting (to be held this year in London) on Wednesday, July 19, under the title of " The Control of Charges and Profits of Statutory Undertakings in (1) Private or (2) Public Ownership and the Accounts relating thereto—*e.g.*, (*a*) Railways, (*b*) Docks and Harbours, (*c*) Water, (*d*) Gas, (*e*) Electricity, and (*f*) Tramways."

Than Mr. Cash, who as a Past-President of the Institute of Chartered Accountants, has given evidence before Government Commissions, and now occupies the unique position of President of both the British Commercial Gas Association and the British Waterworks Association, there is probably no one better qualified to undertake the presentation to delegates from overseas of the principles and peculiarities associated with the accounting and legislative restrictions under which public utility undertakings in this country have developed, with the primary object of service to the public. We would express the hope that the dissemination of such interesting information as is comprised in the unromantic wording of the title will cause not only the foreign and colonial accountants to marvel at the tremendous strides made by public utilities in this country, but will impress upon those nearer at home the unanswerable claims of gas undertakings for relief from the many unnecessary and irritating formalities in regard to methods of charge, dividends, &c., still imposed upon them by antiquated legislation under the mistaken view that these limitations are essential in the public interest. The record of these undertakings will, we are convinced, show that further freedom would not be misused and would be to the advantage of the trade and industry of this country in general.

CORRESPONDENCE

Wise Spending.

SIR,—Economy, by leaving money in the pockets of those best able to use it, was supposed at one time to increase the purchasing power of the people.

Does it to-day? The experience of the past couple of years leads one to doubt it. For economy, in the literal sense of the word, means a drawing in of the purse-strings, and the habit is catching. The result? Economy sterilizes purchasing power instead of increasing it.

A new bridge or a new road, where growing traffic needs demand them, means work and employment for many who would otherwise be on the dole. It means also wages to be spent with local tradespeople.

Economy, as recently defined, demands that we do without that bridge. Sanity demands that we build it. Which is the wiser policy for the ratepayer and trader to support? The latter, I maintain.

Tradesmen, whatever their line of business, want to see local spending power increased. The building of that new bridge means increased spending power in the territory on which they depend for their custom. Therefore, with all the power at their command, they ought to encourage local schemes of development. They are not doing it. Unwisely, in their own interests as in the interests of the nation, they have accepted the economy call, and, believing that enterprise by local authorities is somehow or other detrimental to their business, they have succeeded in stopping many of the projects which would have added materially to their own prosperity, as well as increasing the wealth of the community.

Self-interest is still a salutary test of patriotism. Applied here it would quickly complete the rout of those self-appointed "economists" who are so largely responsible for the troubles with which we still find ourselves beset.

In all humility, I challenge you and your readers to confute that argument.

Yours, &c.,

L. HILL,

General Secretary.

National Association of Local Government Officers,
24, Abingdon Street,
Westminster, S.W. 1,
June 30, 1933.

Cheap Gas for Industry.

SIR,—It is very refreshing indeed to see a Presidential Address so brilliantly and poetically written as that of Mr. Braidwood, of Coatbridge. A fighting spirit always appeals to me!

I should like to enter the lists on one issue with which I am more than a little concerned. On p. 927 of the "JOURNAL" for June 28 there is a paragraph beginning "It must be accepted as a fact that gas of from 450 to 500 is the quality preferred by the Gas Industry," and ending "there is no need to manufacture low-grade gas with a high nitrogen content in order to produce the therm cheaply. In fact, it can be shown that the reverse is the case."

There is not one word in this paragraph that is true.

Mr. Braidwood gives a table of costs into holder from the *Gas World*, but he does not give the lowest selling prices also in the *Gas World*. Gas cannot be sold at the right price if it is not produced at the right price, and to produce gas into holder at the Coatbridge figure of 2d. per therm stands for very little indeed. This achievement is the result of Coatbridge being able to buy coal and sell coke at favourable prices. In no sense whatever, in my opinion, does this show good working. It may show good commercial results.

The test that I have to apply to a good system of gas manufacture is this: What can Coatbridge (or any other gas undertaking) sell gas for in large quantities used every hour of the day throughout the year? Can they sell at 2¼d. per therm? If they cannot do so, I would submit that they are a very long way from the goal the Gas Industry is seeking.

At this very moment I am being consulted as to the obtaining of town gas for an industrial requirement. Whether it be 500 or 200 C.V., at something under 2d. per therm. The undertaking in whose district the requirement is has been kind enough to offer the industry concerned (using what is an ideal load) gas at 5d. per therm. If the requirement were in Nuneaton I should be prepared to supply 200 C.V. gas at considerably less than 2d. per therm and make a good profit.

Yours, &c.,

GEORGE HELPS.

Nuneaton Gas Company,
Queen's Road, Nuneaton,
June 30, 1933.

PERSONAL

PRESENTATION TO MR. ARTHUR EDBROOKE.

In an atmosphere of appreciation and goodwill, and surrounded by his business colleagues in the Board Room of the Bristol Gas Company, Mr. Arthur Edbrooke, Assistant Secretary, was presented with a silver salver, silver fruit stand, and a pair of Zeiss field glasses, all suitably inscribed, on the occasion of his retirement after nearly fifty years' service with the Company.

Mr. Edbrooke was appointed on the official staff of the Bristol United Gaslight Company on Feb. 4, 1884, and was appointed to the position of Assistant Secretary on March 28, 1917.

Mr. S. E. Halliwell, Secretary and Commercial Manager, who made the presentation on behalf of the officials, was supported by the Chief Engineer, Mr. R. Robertson, the Heads of the Secretarial, Engineering, and Distribution Departments, and the whole of the staff.

In referring to Mr. Edbrooke's lengthy service with the Company, Mr. Halliwell mentioned that the recipient of their good wishes had served under ten Chairmen and thirty-one Directors, and had also been associated with four Secretaries—the three previous holders of that position being the late Mr. H. H. Townsend, Mr. James V. Green, and Mr. John Phillips. It was also mentioned that Mr. Edbrooke was appointed Assistant Secretary on the same day that the present Secretary received his appointment.

Mr. Halliwell testified to the exceptional ability with which Mr. Edbrooke had always carried out his duties, and stated that he retired with their sincere respect and good wishes.

The Chairman of the Company, Mr. George H. Boucher, had written expressing his appreciation, and that of the whole of the Directors, of the services so efficiently and loyally rendered by Mr. Edbrooke, together with the hope that he would long be spared to enjoy to the full his well-earned retirement.

Mr. Robertson (Engineer) and Mr. Herbert F. Garrington (Chief Accountant) also expressed their good wishes in appreciative terms.

Mr. Edbrooke said that he highly appreciated the very kind remarks which had been made, and wished to assure his colleagues that he would value their handsome presents not only for their intrinsic worth, but more particularly as tokens of good fellowship and reminders of the kindness and support which had always been accorded him. The knowledge that he was carrying into his retirement their goodwill and good wishes was a source of real gratification to him, and he asked them to accept his sincere and heartfelt thanks.

* * *

Mr. J. L. JENNINGS, of the Lowestoft Gas Company, has been appointed Assistant Secretary to the Bristol Gas Company, in succession to Mr. A. Edbrooke; and Mr. G. H. PALMER, A.C.A., has been appointed Deputy Accountant and Registrar.

* * *

The late Mr. Frederick D. Marshall, of Millers Point, Mayfield Road, Weybridge, left estate valued at £12,007, with net personalty £2188.

* * *

Mr. ROBERT SCOTT, who has for some years past represented Messrs. Thomas Glover & Co., Ltd., in Birmingham and the Midlands, has been appointed Special Representa-

tive to assist the firm's Managing Director, Col. W. R. Glover, and the Sales Director, Mr. James A. Maclay. Mr. A. SNELL will be taking over the ground hitherto worked by Mr. Scott, and his Headquarters will be at Gothic Works, King Edward's Road, Birmingham.

* * *

Mr. WILLIAM H. MCKERRACHER, Manager for the Lesmahagow Gas Light Company, Ltd., has retired after 43 years' service with the Company. A native of Greenock, he acquired his experience at Bo'ness and Dunfermline, and in 1885 was appointed foreman at the Helensburgh Gas-Works. Five years later he was appointed Manager of the Lesmahagow Gas-Works. In eight years he reduced the price of gas from 6s. 3d. to 3s. 9d. per 1000 c.ft.

* * *

Sir FRANCIS GOODENOUGH is one of the Honorary Delegates invited to attend the Thirteenth Congress of the Federation of Chambers of Commerce of the British Empire which is meeting in London this week and was opened by the Prime Minister at the Guildhall on Monday. Sir Francis, who is a Vice-President of the Royal Society of Arts, was last week re-elected a member of the Executive Council for the ensuing year.

* * *

At the Annual General Meeting of the Association for Education in Industry and Commerce, held in London on June 27, Sir FRANCIS GOODENOUGH was re-elected President, and Mr. R. W. FERGUSON Chairman, for the ensuing year. Representatives of the Association were appointed to confer with representatives of the British Association for Commercial Education (of which Sir Francis is Chairman) as to the possibility of amalgamation or affiliation between the two organizations, with a view to concentration of effort and economy of operation.

* * *

Mr. GEORGE J. RIMMER, of Wallasey, has been appointed by the Gas Committee of the Hinckley Urban District Council to the post of Technical Assistant and Chemist of the Hinckley Gas Undertaking. Mr. Rimmer was for six years a student at the Oldershaw Secondary School, Wallasey, continuing his studies for the qualifications of Bachelor of Science of the London University and Membership of the Institutions of Gas Engineers and Mechanical Engineers at the Liverpool Central Technical School.

For the past seven years Mr. Rimmer has been in the employment of the Wallasey Corporation on the Technical and Engineering Staff of the Gas and Water Department. He commenced in 1926 as a Junior in the Chemical and Analytical Laboratories at the gas-works and has since carried out duties in the gas-works and in the drawing and engineering offices. In January, 1931, he was promoted to his present post of Junior Technical Assistant and has carried out extensive duties in connection with engineering works for the provision and supply of both gas and water.

OBITUARY

The death has taken place of Mr. F. J. WARD, Engineer, Manager, and Secretary of the Knowle and District Gas Company, Ltd. He was a member of the Solihull Council for a number of years.

* * *

The death has occurred, at the age of 67 years, of Mr. HARRY ROBERTS, a Director of the Drighlington and Gildersome Gas Light Company for 40 years and for the past 23 years Chairman of the Company. He succeeded his father, the late Mr. George Roberts—one of the founders of the Undertaking—in the Chairmanship after the latter had had over half a century's connection with the Company. Mr. Harry Roberts was the fourteenth generation of a family who had lived at Wood End Farm, Farnley, but moved as a lad with his father to Ings Hall, where his own sons still carry on the family tradition.

THE NEWS OF THE WEEK

The "Veritas" Mantle Works of Messrs. Falk, Stadelmann, & Co., Ltd., at Wandsworth, were visited on Saturday, June 24, by members of the Western Junior Gas Association. After a tour of inspection, lunch was provided at which Mr. Max Falk, Chairman of the Company, presided.

The Annual Picnic of members of the Accrington and District Gas Board office staff was held on June 21, when a party of thirty enjoyed a motor outing to Morecambe and Blackpool. The outward run was via Settle and Ingleton, the party making a tour of Ingleton Falls. Tea was provided at the Winter Gardens at Blackpool.

The Insurance of the Technical Staff of the Gas Department is recommended by the Bradford Gas Committee for those not covered by the Workmen's Compensation Act in respect of fatal injuries arising out of the course of their employment. The indemnity is £1000 each, at a cost of 12s. 6d. per annum per member of such staff.

An Additional Charge of 10% is proposed by the Birkenhead Gas Committee to consumers outside the Borough for central heating purposes, where the consumption does not exceed 750,000 c.ft. per quarter. The present charge in cases where the consumption does not exceed 750,000 c.ft. per quarter is a flat rate of 4d. per therm.

Gas Undertaking Auctioned.—Messrs. Bufton & Son, of Llandrindod Wells, offered for sale by auction at the Radnor Arms, Presteign, as a going concern, the undertaking of the Presteign Gas and Coke Company (in voluntary liquidation), including the freehold property, plant, machinery, equipment, and mains. Bidding was brisk and the property was purchased by Mr. W. H. Martin, of Presteign.

A Successful Exhibition of Gas Appliances was held recently by the Middlesbrough Corporation Gas Department at the Town Hall, at which the latest ideas in gas cooking and heating were demonstrated. The Mayoress (Miss Brown) in opening the exhibition, which attracted large attendances, referred to the cheap price of gas in the town and hoped that housewives would discover many improved ways of doing things by gas.

"The House of Magic Taps" is the name which has been given to the model all-gas exhibition house recently opened by the Birkenhead Corporation Gas Department, in co-operation with a number of Wirral tradesmen at Heswall. Gas is employed in the house for every purpose, from lighting to running a refrigerator, and it is, from the gas standpoint, one of the most complete dwellings of its kind ever erected in the county of Cheshire.

Sawer & Purves' Annual Picnic.—The staff and employees of Messrs. Sawer & Purves, Ltd., held their Annual Picnic and Bowling Handicap at Chester on June 24, and had a very enjoyable day. Arriving at Chester by road coaches, the bowlers commenced their game while others, preferring to look round the historic city, went to view the Cathedral, the City Walls, and other objects of interest. They were fortunate in being guided by Officials from the Chester Gas Company, who kindly undertook this task. Great enthusiasm was shown when the finalists bowled again, and cheers rang out when the tinshop knew they would again carry off the cup. Mr. Morley, in presenting the prizes, said he was glad they had such a large gathering and felt sure everyone had spent a most enjoyable time. These gatherings did a great amount of good and created good feeling between the firm and employees. Everyone looks forward to next year's trip, and agrees this was the "best ever."

XUM

THE NEWS—*continued.*

Imperial Chemical Industries, Ltd., inform us that the home price of neutral sulphate of ammonia for delivery July/August will be £6 15s. per ton for 6-ton lots carriage paid buyers' nearest station.

It is Proposed to Spend £18,000 at the Stalybridge Corporation Gas-Works on carbonizing plant renewals. Stalybridge Town Council has approved an application by the Gas Committee to the Ministry of Health for sanction to borrow this amount.

Large-Scale Uses of Gas having been the subject of several inquiries in Bradford lately as a result of the new two-part tariff, the Gas Committee have decided to send a member of the Gas Department staff for a period of three months' technical instruction at the Industrial Laboratories and Sales Section of the Birmingham Gas Department. This representative will be paid a suitable expenses allowance in addition to salary during that period. The decision is consequent on Mr. E. Crowther (the Engineer and Manager) reporting that industrial gas usage in Bradford hitherto has not been such as to provide a sufficiently varied and extensive experience to deal with all inquiries which might come along to the best advantage.

An Emergency Night Service has been instituted by the Birmingham Corporation Gas Committee for dealing with emergency calls for consumers after office hours. A small fleet of Austin Seven vans, carrying the requisite tools, spare meters, &c., is stationed at the Council House from 6 p.m. during the first five days of the week, from 1 p.m. on Saturday, and all day on Sunday. The fitter drivers in attendance, who work on a rota scheme, remain on duty until approximately 11 p.m. each evening or until the whole of the emergency calls have received attention. This emergency scheme was brought into operation in September last and covers the whole of the Undertaking's area of supply. The scheme has worked satisfactorily, and the Committee are convinced that apart from maintaining the goodwill of consumers, it will enable the Department to deal promptly with what might be dangerous conditions.

Gas Light and Coke Company's Bill in the House of Lords.

We are glad to learn that all opposition to the Gas Light and Coke Company's Bill, which, as stated in last week's "JOURNAL," had been referred to a Select Committee of the House of Lords for consideration, was on Monday officially withdrawn. The Bill will, therefore, now be taken by the Committee on Unopposed Bills.

Early Rush for 1934 B.I.F.

Within twelve days of the issue of application forms for the 1934 British Industries Fair, the Department of Overseas Trade announces that more than 100,000 sq. ft. of exhibition space has been booked by exhibitors in the various sections—excluding textiles—at Olympia and the White City.

Bookings for the Birmingham Section of the 1934 Fair are 25% in excess of those recorded up to this time last year.

Rotary International.

The 14th Annual Conference of Rotary International (Association for Great Britain and Ireland) was held at Scarborough in May last. The Proceedings have now been published, and we note that Mr. Ernest Ablett, Secretary to the Swansea Gas Light Company, is Secretary and Treasurer of District 15.

Prior to the conference Mr. Ablett was invited to act as Vice-Chairman of the Vocational Meeting on Light, Power, and Heat. At the meeting, owing to the illness of the Chairman originally appointed, Mr. Ablett presided, and submitted a report.

Institution of Gas Engineers.

Copies of the following recently issued British Standard Specifications may be obtained, price 2s. each, from the Secretary of the Institution of Gas Engineers, 28, Grosvenor Gardens, S.W. 1:

No. 492-1933: Precast Concrete Partition Slabs (Solid).
No. 494-1933: Cold Drawn Weldless Steel Boiler and Superheater Tubes.

A copy of "Pipe Corrosion," being a Paper by Mr. A. C. Pallot, B.Sc. (Eng.), A.M.I.E.E., presented at a Sessional Meeting of the Institution of Heating and Ventilating Engineers in London on March 2, 1932, may be inspected in the Library of the Institution of Gas Engineers, 28, Grosvenor Gardens, London, S.W. 1.

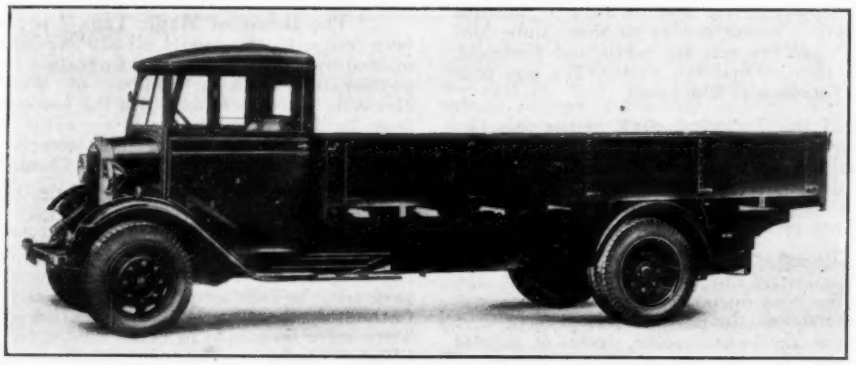
A copy of "The Purging of Gasholders," being the procedure recommended by the American Gas Association for purging and placing gasholders into service or removing them from service, may also be inspected in the Library of the Institution.

Explosion at Wrexham.

On Thursday, June 22, an accident occurred at the Wrexham Gas-Works; but we are glad to be informed by Mr. Owen Evans, the Engineer and Manager, that the result was not nearly so serious as implied in most of the newspaper reports.

The Works Assistant, Mr. J. F. Lloyd, and three men were engaged on a periodical examination of a by-pass governor fixed between the trunk inlet and outlet mains to the gasholders. A connection was taken off to clear a

Morris Commercial Vehicles Shown at Derby



Readers interested in transport will have an opportunity of seeing the latest motor vehicles at the Royal Agricultural Show, Derby, July 4 to 8. Messrs. Morris-Commercial Cars, Ltd., have taken a large stand and are exhibiting a full range of new vehicles they have just introduced, these being of special interest in view of the many advanced chassis features embodied, including choice of four or six cylinder models, four-speed twin-top gearbox, triangulated frame bracing, Lockheed hydraulic four-wheel brakes, progressive rear springs, fully floating rear axle, all-steel cab, and finger-tip controls. The Morris-Commercial exhibits include a 30-cwt. forward control lorry with four-cylinder engine, a six-cylinder 2-ton end tipper, a 3-ton forward control six-cylinder lorry (illustrated above), a 70-cwt. "Leader" lorry, a 1-ton van, and an ambulance.

deposit of naphthalene, and owing to an inlet valve not closing tightly an escape of gas occurred which unfortunately ignited from a cause which has not yet been definitely ascertained.

The inlet main was quickly isolated and the fire put out, and very little damage was done to the plant, with the exception that a wooden structure surrounding the governor was destroyed. The Assistant and the three men received burns to their faces and arms. The three men are well on the way to a speedy recovery, and Mr. Lloyd, who was rather more seriously injured, is making satisfactory progress.

Normal working was proceeding very shortly after the accident, and the supply of gas to the district was not interrupted in any way.

Leeds University.

The following are the results of the 1933 Degree Examinations in the Fuel Department of Leeds University:

B Sc. (Ordinary).

N. R. Balmford, F. Bell* (Corbet Woodall Scholar), G. E. Hall (Cartwright Holmes Scholar), G. E. Holmes, J. W. Raine, N. B. Sands, D. Sismey, H. Smith, and M. H. Wheeler.

B.Sc. (Honours).—Gas Engineering.

Class I.

H. C. Millett, for thesis entitled "The Influence of Sulphur Dioxide on the Scaling of Steel."

Class II.

A. C. Bureau, for thesis entitled "An Investigation of the Effect of Blending Wood and Charcoal with a Bituminous Coal, with Particular Reference to the Reactivity of the Cokes Produced."

B.Sc. (Honours).—Fuel and Metallurgy.

Class II.

H. D. Brook, for thesis entitled "A Surface Examination of Scales Produced on Mild Steel."

Diploma in Gas Engineering (Post-Graduate)

T. G. Spalding (B.A. (Oxon.) Honours).

* An additional term's attendance required before graduation.

H. C. Millett was elected to the Arthur Smithells Scholarship and received the Leblanc Medal.

Properties, Uses, and Treatment of Metals.

It is of interest to note that the educational authorities are recognizing the necessity of a sound knowledge of the physical, chemical, and mechanical properties of metals and metallic alloys by those employed in the less academic spheres of industrial life.

In the past this branch of education has been left primarily to the professional classes. To-day, with the increasing application of metallic alloys and the need for special mechanical and heat treatment of them, evening classes dealing with the more practical and engineering sides are available for salesmen, fitters, and artisans employed in the various positions in engineering firms and allied trades. This should undoubtedly give them a much wider view of, and greater efficiency in, their particular work, and it is understood that the managements of some firms have recognized this to the extent of giving facilities and paying expenses.

With the extending use of gas for all kinds of industrial processes, and particularly the heat treatment of metals, these classes should be of interest to all employed in the Gas Industry. Among the classes held in the School of Metallurgy at the Chelsea Polytechnic, Manresa Road, Chelsea, are the following:

(*a*) Junior Course for those apprenticed or employed as fitters, engineers, brass finishers, toolmakers, moulders, welders, and allied trades.
(*b*) Senior Course for technical and industrial representatives and salesmen in engineering firms.
(*c*) Two-Year Course for those studying for the examinations of the Engineering Institutions, and those holding administrative positions in all branches of Engineering. [This Course has been recognized by the Institution of Gas Engineers.]

Industrial Co-Partnership Association.

The Annual Summer Conference of the Industrial Co-Partnership Association will be held at Somerville College, Oxford, during the week-end of July 21-24. The general title of the Conference will be "Co-Partnership and Industrial Changes."

Viscount Cecil of Chelwood, Joint President of the Association, will preside at the opening session, when the Rt. Hon. J. H. Whitley will give a review of the Industrial Councils Movement.

Among those who will take part in the Conference are Sir Richard Paget, Prof. D. H. Macgregor, Miss Lynda Grier, Mr. J. Spedan Lewis, and Mr. J. P. Gamon, the Deputy-Chairman of the Chester United Gas Company.

This photograph, for which we are indebted to Mr. C. R. Ingham, Engineer and Manager to the Brighouse Gas Department, is of a decorated lorry entered by the Department in a recent local demonstration. The simplicity of the exhibit is most effective.

South Wales Industrial Centre.

A meeting of the Special Development Committee of the South Wales (Cardiff) Industrial Gas Centre was held at the Gas Offices, Bute Terrace, Cardiff, on Wednesday, June 28, when the Report sent out from the Centre dated May 8 was considered. Afterwards an inspection was made of the Central Industrial Laboratory and Demonstration Room, where, in particular, an experimental furnace suitable for converting steam coil heated bakers' ovens from solid fuel firing to gas firing was seen under actual working conditions.

The membership of the Centre now totals fifteen, being an increase of one since the last meeting.

Wandsworth Company's Steady Progress.

The Wandsworth and District Gas Company, stated the *Financial Times* in a recent "Potential Investments" column, was incorporated in 1912 as an amalgamation of the old-established Wandsworth and Putney, Mitcham, and Wimbledon and Epsom, and Ewell undertakings. In 1930 the undertaking of the Kingston-upon-Thames Gas Company was acquired, and that of the Sutton Gas Company in 1931.

The area of supply comprises 77 sq. miles, and includes thickly-populated Metropolitan boroughs and that important south-west London corridor extending many miles along the Surrey side of the Thames. The Company now ranks third among the Metropolitan gas undertakings.

Operations have rapidly increased, and further considerable expansion must occur as the development of the several areas proceeds. Since 1926 sales of gas have increased without interruption from under 23 million therms to nearly 27 millions. It is of interest that the Company

THE NEWS—*continued.*

owns a fleet of four steamers, with an aggregate carrying capacity of about 7400 tons, which greatly contribute to the economical working of the undertaking.

Throughout the whole of the limits of supply, the basic price of gas is 11d. per therm. The selling prices at present are: Wandsworth 7 3-5d., Wimbledon 8 1-5d., Kingston 9d., Epsom 9 4-5d., and Sutton 8 3-5d. per therm. Since the beginning of 1930, when the various stocks were consolidated into one class, the dividend paid has been at the rate of 7% per annum, or 2% above the basic rate. On Dec. 31 last the reserve fund stood at £43,948 and the special purposes fund at £69,177.

The authorized capital (including premiums, less discount) amounts to £2,816,266. Borrowing powers amount to £1,689,760, against which there is outstanding £1,317,964 of 5% debenture stock. This is quoted at 125 to yield 4%.

New Scale of Charges at Middlesbrough.

The Gas Committee of the Middlesbrough Corporation have just approved of a new scale of charges for gas to ordinary meter consumers and also a scale for gas used in central heating systems, as shown below.

It will be observed that the Gas Committee are prepared to quote special terms to industrial users of 1 million c.ft. and upwards per quarter.

Scale of Charges for Gas Supplied Within the Borough, After Reading of Meters for June Quarter, 1933.

(1) Ordinary Meter Consumers.

Quarterly Consumption.	Price per 1000 C.Ft.		Price per Therm.	
	Gross.	Net.	Gross.	Net.
C.Ft.	s. d.	s. d.	d.	d.
First 20,000	1 11·50	1 9·15	4·70	4·23
Next 230,000	1 9·50	1 7·35	4·30	3·87
250,000	1 9·66	1 7·49	4·332	3·899
Next 250,000	1 7·50	1 5·55	3·90	3·51
500,000	1 8·58	1 6·52	4·116	3·705
Next 250,000	1 5·50	1 3·75	3·50	3·15
750,000	1 7·55	1 5·59	3·911	3·520
Next 250,000	1 4·50	1 2·85	3·30	2·97
1,000,000	1 6·78	1 4·90	3·758	3·383
In excess of 1,000,000	1 3·00	1 1·50	3·00	2·70

(2) Central Heating Systems.

Quarterly Consumption.	Price per 1000 C.Ft.		Price per Therm.	
	Gross.	Net.	Gross.	Net.
C.Ft.	s. d.	s. d.	d.	d.
First 20,000	1 11·50	1 9·15	4·70	4·23
In excess of 20,000	1 4·50	1 2·85	3·30	2·97

(3) Industrial Purposes Using One Million C.Ft. and Over per Quarter.

Each case to be dealt with on receipt of application, and supplies of gas offered on special contract agreements covering price, period, and other conditions.

In all cases the scales apply to consumptions through one meter, and the gross prices are subject to 10% cash discount. These scales will also apply outside the Borough with the additional charges at present in operation in the various areas.

Manchester Juniors.

A large party of members of the Manchester and District Junior Gas Association, accompanied by ladies, visited the Aintree Biscuit Factory of Messrs. W. R. Jacob & Co., Ltd., Liverpool, on Wednesday, June 28. They were received by the Works Manager, Mr. W. G. Smith.

The works is built on a site of some 30 acres and set in the midst of most pleasant surroundings, spacious lawns, and flower beds, which set off the principal approaches to the works. There is a well-equipped laboratory charged with the responsible duties of testing every ingredient before use.

The utmost skill is required to ensure that the biscuits pass through the ovens at the correct speed and are subjected to the correct temperature while doing so. All the ovens are heated by gas. [The "Gas Journal" report of the Institution of Gas Engineers' visit on May 31 to these works gives details of the gas heating of the biscuit ovens, boilers, &c.]

The welfare of the workpeople is well catered for, and the scheme includes free medical advice and dental treatment, rest rooms, cricket pitches, tennis courts.

Gas Supply in Spain.

Despite the ever increasing use of electricity and notwithstanding the economic depression satisfactory progress continues to be made in the use of gas in Madrid, in which city the supply is in the hands of the Sociedad Gas Madrid. The output during 1933 reached a total, in round figures, of no less than 1,217,850,000 c.ft., as compared with only 1,059,000,000 c.ft. in the preceding twelve months—an advance of 15%.

As a result of active propaganda work and the maintenance of attractive showrooms in one of the principal arteries of Madrid, the number of consumers is steadily advancing, having increased from 20,285 in 1931 to 24,167 at the end of last year. In addition, a considerable amount of street lighting by gas is undertaken, there being a total of about 19,000 lamps in operation. The distribution mains were further extended during the past year and have now a length of about 375 miles.

Scottish Junior Gas Association.

(Eastern District.)

The Annual General Meeting of the Association took place in the Heriot-Watt College, Edinburgh, on the afternoon of Saturday, May 13. The Office-bearers for next season were appointed as follows:

President.—William Scott, Tillicoultry.
Vice-President.—Sydney Smith, Dunfermline.
Hon. Secretary and Treasurer.—A. C. Rea, Granton.
Librarian.—Arthur Doran, Granton.
Auditors.—M. Darling, Cowdenbeath; C. L. Farquhar, Kennaway.

The following members were elected to the vacancies in the Council: A. Doran, Edinburgh; J. Dow, Kirkcaldy; C. D. Blackhall, Edinburgh; and R. Cowie, Hawick (for one year).

It was unanimously agreed to ask Messrs. James Jamieson, Edinburgh; A. W. Farquhar, Lower Largo; and M. Darling, Cowdenbeath, to accept Hon. Membership of the Association.

Summer Outing to Dundee.

Lady friends and members of the Association held their Summer Outing at Dundee on Saturday, June 10.

The party met at Dundee West Station at 10 a.m., where a 'bus conveyed the ladies to the Works of Jute Industries, Ltd. An instructive forenoon was spent watching the different carpet manufacturing processes. At the conclusion of the visit Mr. Sydney Smith (Dunfermline) returned thanks on behalf of the Association to the Directors and Manager.

In the forenoon the male members of the party visited the gas-works, where they were met and conducted round the plant by Mr. John Wilson, Engineer and General Manager, and members of the technical staff. Much interest was evinced in this well-equipped and up-to-date station.

The party re-assembled in Ingram's Restaurant, Reform Street, for lunch.

In the afternoon those present were entertained to a 'bus tour of the City, by the kind invitation of Dundee Corporation. A stop was made at the Lawton Housing Scheme and an inspection made of the houses. The journey was continued via the Garden City to Broughty Ferry. A stay for 1½ hours on the Links was made, during which a Putting Competition was enjoyed. The party again proceeded to Ingram's Restaurant, where they were entertained at tea by the Corporation.

After tea, Mr. David Warden, of Dundee, the President, returned thanks to the Dundee Corporation for the excellent arrangements made for the visit; and Mr. John Wilson replied.

Mr. William Scott, of Tillicoultry, returned thanks to the Dundee Technical Staff for their assistance in making the outing so successful; and Mr. James Storrier suitably acknowledged.

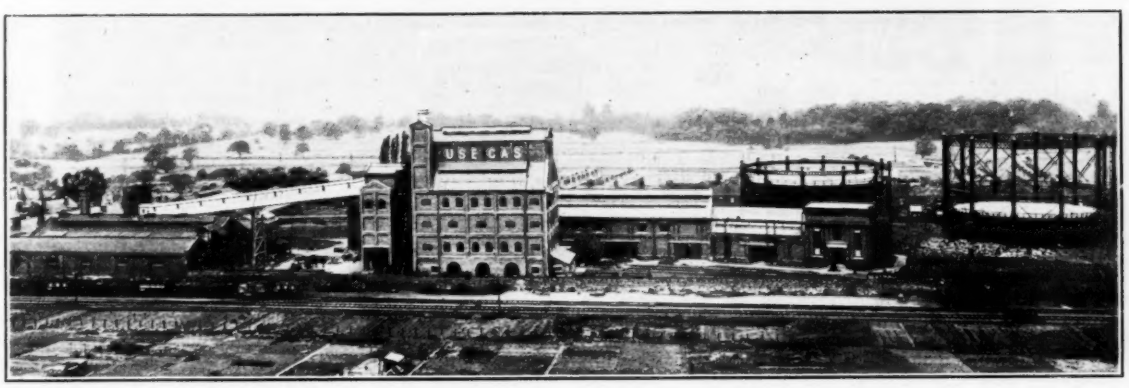
Mrs. David Warden, then presented the putting prizes to Miss Richmond, of Penicuik, 1st lady, and to Mr. Jack Ireland, of Carnoustie, 1st gentleman.

A hearty vote of thanks was awarded Mr. and Mrs. Warden, and the meeting concluded.

LINCOLN LOOKS - - - AHEAD - - -

A Big Gas-Works Reconstruction Scheme

On Wednesday last Lincoln inaugurated in cheery manner the completion of a heavy scheme of modernization of its gas undertaking, by which the Corporation of this lovely old City (which at the same time is no mean industrial centre) have demonstrated practically their faith in the future of Gas.



VIEW OF RECONSTRUCTED BRACEBRIDGE WORKS, FROM THE NEW GASHOLDER.

DEVELOPMENT OF GAS SUPPLY IN LINCOLN.

The manufacture of gas in Lincoln commenced at Newland Works in 1830 under the auspices of the Lincoln Gas Light and Coke Company, Ltd. The capital consisted of £8000 in shares, and £1800 mortgage. The total receipts for the first year were £1515, and the net result a loss of £330. Wages paid amounted to £436 per annum. The number of street lamps was 76.

The Bracebridge Works were opened in 1876.

In 1885, the Gas Undertaking was purchased from the Company by the Lincoln Corporation, when the manufacture of gas had been increased to 163 million c.ft., the number of consumers being 5789, and the length of main 35 miles. In 1913 the price of gas in the City reached its lowest figure—namely, 2s. per 1000 c.ft.

The returns of the Undertaking at March 31, 1933, show that wages paid during the year were £25,996. The length of mains 102 miles, number of consumers 17,976, number of public lamps 1884, gas cookers in use 12,242, coal carbonized 33,257 tons, oil used 14,014 gallons, coke made 21,617 tons, tar made 412,275 gallons, sulphate of ammonia made 324 tons. The annual make of gas is 560 million c.ft., the increase being approximately 25% in the last ten years.

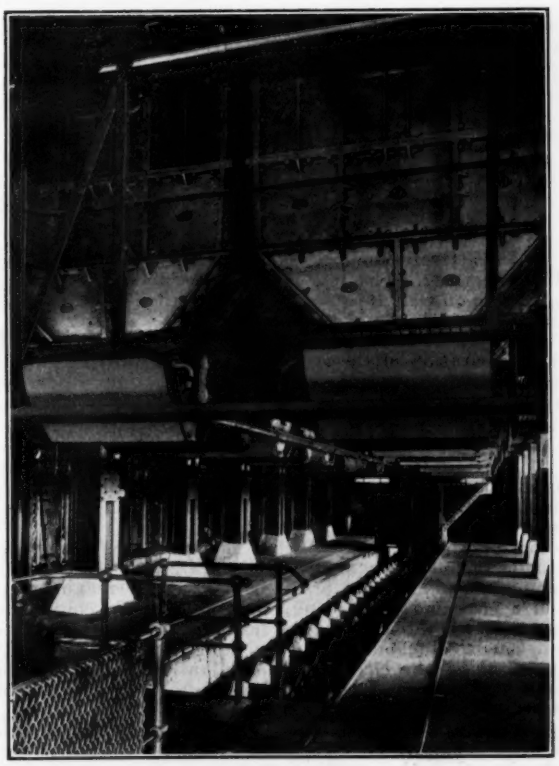
The value of the assets is £468,000, subject to the necessary adjustment of the capital account and balance consequent upon the reconstruction of the works. The total liabilities are £184,000, of which £170,000 is outstanding loans. There is, however, a balance of assets amounting to £284,000, or £100,000 more than the total liabilities.

In 1919 it was thought advisable to appoint a Distribution and Showroom Superintendent. Since that time the sales of appliances have increased materially, the cooker sales showing an increase of 75%, miles of mains 50%, consumers 23%, and the value of gas appliance sales are in the neighbourhood of £66,000. Four years ago it was deemed advisable to close the Showrooms in Saltergate and to open larger and more commodious premises on the present site in Silver Street, a policy which has been amply justified.

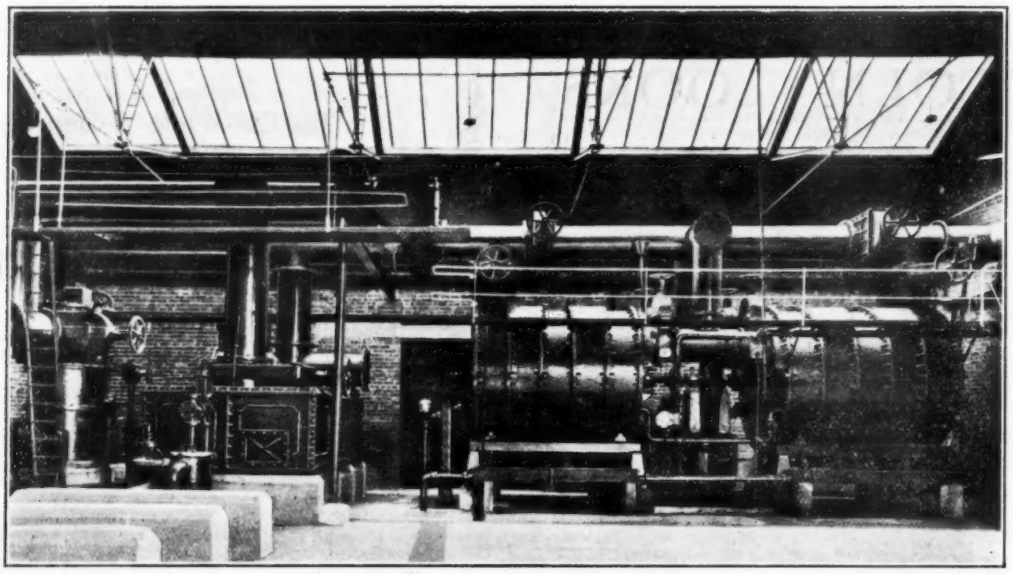
Since 1853 to the present time there have only been four Managers of the Undertaking. Mr. W. P. Throsby was Manager from 1853 to 1880; Mr. John Carter was appointed Secretary in February, 1881, and Manager in 1884 until 1915, when Mr. W. H. Mainwaring, who had been Assistant for many years, secured the position, which he retained until his retirement in March, 1930. It was then decided to appoint an Engineer and Manager, and Mr. George Wright was appointed to the dual post.

Inception of the Scheme.

In view of the serious nature of unemployment in the City, the Council in 1931 asked the officials to put forward



View beneath Woodall-Duckham Settings, showing Coke Hoppers and Dischargers, Travelling Filling Chute, Bucket Conveyor, and Producer Doors.



THE WASHER HOUSE, SHOWING TAR EXTRACTOR, LIVESEY WASHER, AND ROTARY WASHER.

schemes which would help to relieve the situation. The Gas Engineer put forward a scheme for the complete reconstruction of the works which would be calculated to employ a large number of men on the site and, what was equally important, find work for the local firms.

The scheme included not only a new retort installation, but complete new exhausters, tar extractors, washers, purifiers, tar and liquor pits, gas mains, tar and liquor mains, gas governors and station meter. It was decided to install the Woodall-Duckham system. The following firms were entrusted with the orders for the various items in the reconstruction scheme:

Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd.	Continuous vertical retort installation and coal and coke handling plant.
Newton, Chambers, & Co., Ltd.	Condensers, Livesey washers, tar extractor, purifiers, oxide handling plant, steel purifier house roof, gas heater, tar and liquor separating tanks, overhead gas mains and valves.
W. C. Holmes & Co., Ltd.	Rotary washer, Connersville exhausters and boosters, Connersville meter.
Peebles & Co., Edinburgh	Station governor.
Penny & Porter, Ltd., Lincoln	Overhead water storage tank.
M. Otter & Co., Lincoln	Foundations and buildings for purifier house, washer house, and exhauster house.

Work actively commenced on the site in the middle of January, 1932. The new gas-making plant was put into operation on Oct. 10, 1932. Therefore the major portion of the scheme was completed in ten months.

The City Gas Engineer and Manager was responsible for the preparation of the specifications and drawings for the reconstruction scheme, and the construction programme was carried through under his supervision.

Carbonizing Plant.

The installation consists of one bench containing twenty-four latest type upwardly-heated Woodall-Duckham continuous vertical retorts, capable of carbonizing 216 tons of coal and of producing 3,370,000 c.ft. of gas a day. The retort bench is heated with hot gas from a battery of five producers and is provided with duplicate waste-heat boilers, complete coal and coke handling plant, coke screening plant, and a coal and gas testing plant installed in conjunction with an isolated retort. The installation has been erected in a new steel-framed brick-panelled retort house, with the exception of the coke screening plant, and the old horizontal retort house has been converted into a coal and coke store complete with reclaiming plant.

The twenty-four retorts are arranged so that any one retort can be heated up, cooled down, or scurfed without affecting the others. The retorts are about 25 ft. high, rectangular in plan, and tapered to allow continuous regular descent of the coal. They are 82 in. long and 10 in. wide at the top.

The retort design is in accordance with the latest Woodall-Duckham practice into which a number of special features have recently been introduced. While the well-known vertical flue construction is retained, which lends rigidity to the retort structure and also facilitates inspection from one level, the combustion of the heating gases takes place in an upward instead of in a downward direction. This produces a zoning of heats which has been found to give the following advantages: (*a*) Perfectly regular travel of coal; (*b*) less scurf formation, and less loss of time of scurfing periods; and (*c*) better steaming conditions.

The Woodall-Duckham system of upward heating in vertical flues, which follows the natural flow of the hot combustion gases, is particularly simple to put into operation and to control. When the heats have once been regulated, only the steam pressure injecting the primary air to the producers and the waste gas dampers need adjustment.

By the introduction of the upwardly-heating principle the temperature in the vertical combustion flues is sufficiently reduced at the point where erosion of the silica normally takes place to allow the retorts at this level to be constructed with perfect safety in firebrick. By the time the coal has travelled past this belt of firebrick and enters the silica portion of the retort, it has acquired a sufficient heat to avoid the extreme differences in temperature on either side of the retort wall, which are the main cause of the erosion of silica material at this point. In this way the full advantage of silica construction as regards high throughput of coal is obtained, with a reduction in maintenance costs.

With continuous vertical retorts there is a tendency for the ash liberated by steaming to attack the joints in the lower parts of the retorts, where there is no protection by scurf formation.

By spraying the retort faces regularly, when the retort is empty for scurfing, around the region where this chemical action takes place, "slagging" of the brickwork can be avoided and the life of the retort indefinitely prolonged. In the Woodall-Duckham bottom castings specially easy access is provided for inspection and spraying without dismantling the castings.

Producers.

To supply the gas for heating the retorts a battery of five producers is provided at the retort house floor level at one side of the bench. The producers are arranged so that one producer may be shut down without interfering in any way with the working of the other producer. The gas from either of the producers may be taken to the heating flues of any of the retorts.

The producers are of the step-grate type and are constructed with ample grate area for the efficient heating of the retorts when burning a mixture of coke and breeze as well as for burning the additional amount of fuel required for a supplementary supply of producer gas to the waste-heat boiler.

The waste-gas main conveys the gases either directly to the chimney or to one of two waste-heat boilers which are

provided for utilizing the major portion of the heat contained in the gases.

At the coke screening plant the coke is fed on to a 25 tons per hour five-roll grizzly screen, the large size of 2½ inches and over passing down a spiral anti-breakage chute into the end compartment of a range of reinforced concrete storage bunkers, which have a total capacity of 100 tons. The undersize from the grizzly screen passes through a chute into a rotary screen of 20 tons per hour capacity which grades it into three sizes—namely, 0 in.-¾ in., ¾ in.-1¼ in., and 1¼ in.-2½ in.

On one side the bunkers are fitted with four chutes, one to each small coke compartment and two to the large coke compartment. These chutes feed on to a band conveyor for delivering coke to wagons on the siding. On the other side four two-way chutes are similarly fitted and deliver coke either to road vehicles or to a bagging platform. The breeze compartment has one chute fitted at the bottom for delivering into road vehicles or skips.

Gas and Coal Testing Plant.

A plant has been installed for testing gas and coal working in conjunction with one isolated retort contained in the bench. Coal is fed from a separate compartment, made by inserting division plates in the overhead storage hoppers, into the isolated retort, which is so arranged that it can be worked either separately from or in unison with the remaining retorts as required.

One end of the collecting main on that side is isolated and provided with its own cleaning well, liquor circulating and tar and liquor separating system, two uptakes, foul main, and Area regulator. A vertical condenser of 145,000 c.ft. per day capacity is provided in the corner of the retort house, while in an annexe to the retort house are provided a Connersville Victor gas exhauster, a P. & A. tar extractor, Livesey washer, and Connersville positive displacement meter. The latter has a capacity of 3·6 million c.ft. a day and is fitted with a pressure, volume, time, and temperature self-recording apparatus.

Results.

The results obtained on the new carbonizing plant during its first nine months of operation are entirely satisfactory, and the improved yields and lower manufacturing costs have together effected a substantial economy in the cost of gas production at Lincoln. It has already been decided to reduce the price of gas by 3d. per 1000 c.ft., which will cost £7000 over the twelve months.

Laboratory.

The old exhauster house has been converted into a new laboratory, which contains balance room; Boys' calorimeter; a main room fitted with furnace and gas analysis bench; a distillation bench; fume cupboard with tiled base; and apparatus cupboards.

With the idea of showing that a modern gas-works and its surroundings need not be unlovely, and to make more cheerful conditions for the employees, the vacant land round the gasholders has been utilized for flower gardens. Numerous shrubs, all of the flowering variety, have been planted, sunken rose gardens, the walls of which have been formed from the old horizontal retorts, and rockeries made from old concrete foundations and rubble and planted with many different varieties of plants, give a charming effect with the grass borders. The work has been carried out by old employees of the establishment, who are being retained until pensionable.

The New Spiral Holder.

The storage capacity of the works was augmented, just prior to the commencement of the scheme described above, by the erection of 1½ million spiral-guided holder by Messrs. Newton, Chambers, & Co., Ltd. This holder was described and illustrated in the "Journal" for Nov. 4, 1931, p. 308.

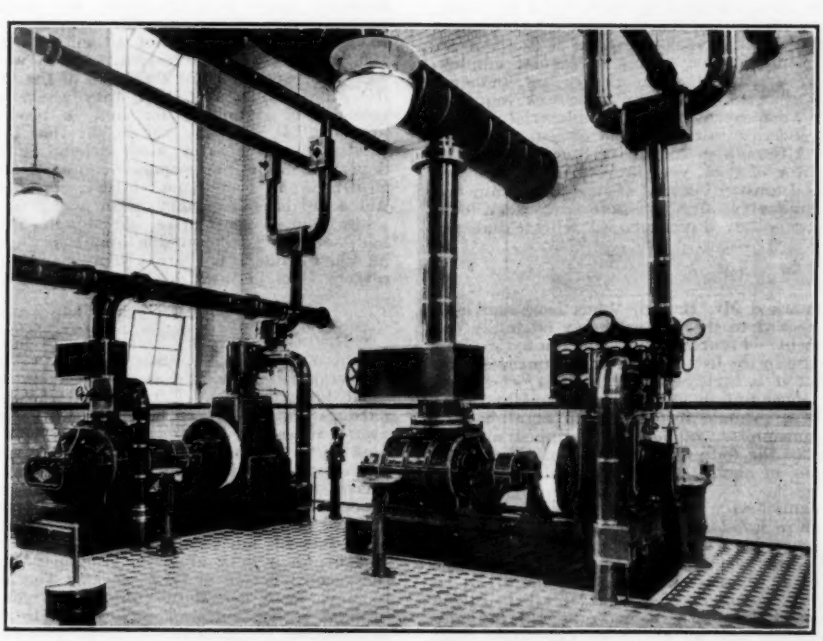
Opening Ceremony.

The works were *en fête* last Wednesday for the opening ceremony, which was performed by Mr. Ernest Brown, M.C., M.P., the Secretary of Mines, in the presence of a large number of Lincoln's leading citizens and many visitors from near and far. The guests assembled near the coke screening plant, where the Mayor (Alderman J. W. Rayment introduced Mr. Brown, who proceeded to perform the opening ceremony by operating the wagon-tippler and starting-up the bucket elevator. Thereafter the Chairman of the Gas Committee (Mr. A. L. Bower) presented Mr. Brown with a silver cigarette box, having upon it the Lincoln coat of arms, as a memento of the occasion. During the brief ceremony there were present on the platform (in addition to Mr. Ernest Brown, Alderman Rayment, and Mr. Bower) Mr. F. P. Tarratt, President of the Institution of Gas Engineers, and Sir Francis Goodenough, Chairman of the British Commercial Gas Association.

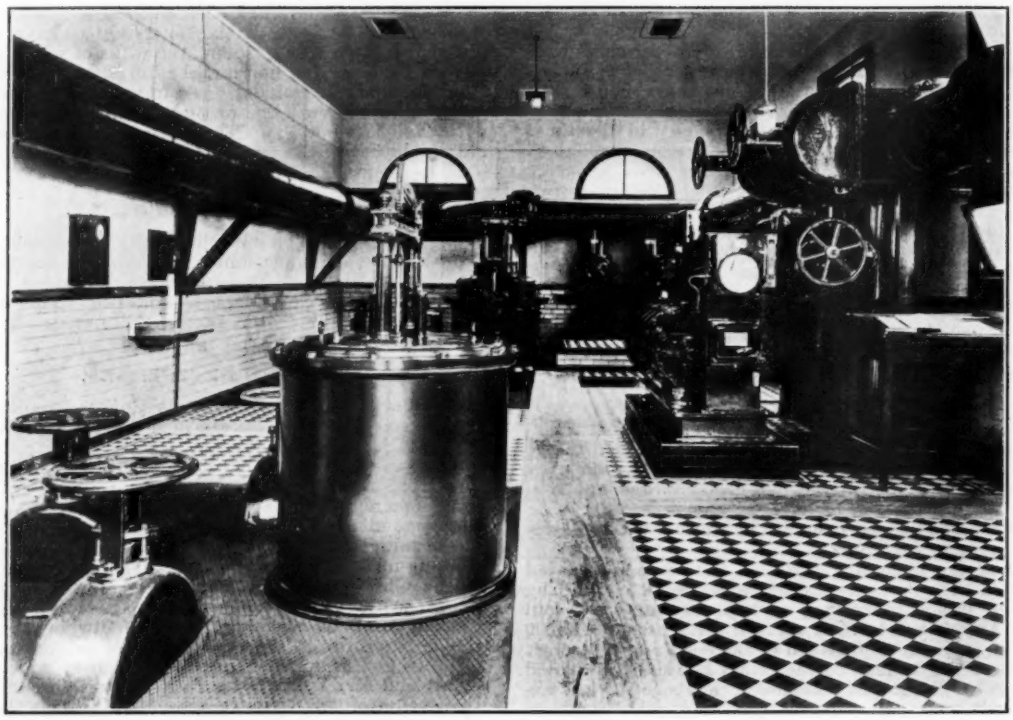
Then the guests formed into groups to inspect the plant, under the guidance of Mr. Wright and members of the staff. Everything received the high commendation which it undoubtedly deserves, and there was general admiration of the tastefully laid out flower beds on the site, with their wealth of roses and other blooms. Tea was served in a big marquee during the speech making which was appropriate to so important a function in the history of the city.

The Gas Industry—Generally and as Exemplified at Lincoln.

The Secretary for Mines said it was a very great joy to him to take part in this ceremony. One of the industries upon which the Minister of Mines was bound to keep a kindly eye was the Gas Industry Lincoln had laid down a gas-works on the most modern principles, and he felt sure they would be justified in their faith. He believed that gas and coal had a very great future. Gas was first manufactured in Lincoln over a hundred years ago. In 1885, when the undertaking was purchased by the Corporation from the Gas Company, the annual make of gas was 163 million c.ft., and the consumers numbered 5789. The returns at March 31 last showed the number of consumers to be 17,976; the make of gas during the twelve months being 360 million c.ft.



THE EXHAUSTER HOUSE, SHOWING A NEW EXHAUSTER AND A BOOSTER.



THE METER HOUSE, SHOWING THE STATION METER AND GOVERNORS.

To cope with this expansion the Corporation had now this fine works, undertaken at a very difficult time as a measure to relieve unemployment. Having compared prices of gas all over the country, he found that the charge at Lincoln was below the average.

Our Native Energy.

He was present that day as the Minister of Mines, and he thought it was time some one put up a fight for the country's native energy. Coal was our greatest national industrial asset. Unlike other countries which could derive power from water or oil fields, Great Britain depended for her prosperity to a very large extent on the products of her mines. It was therefore of the utmost importance, if they wanted to hold their own in the markets of the world, that they should make the best and most scientific use of the coal at their disposal. The nation was moving in that direction. The gas and electricity industries were both making good use of the products of our mines. Low-temperature carbonization was producing smokeless, clean-burning fuel. Gas had rightly been called "the spirit of coal," for when coal was carbonized at the gas-works, 80% of its original potential energy was absorbed in the form of gas, coke, tar, sulphate of ammonia, and chemical bye-products. Gas undertakings purchased annually about 18,000,000 tons of British coal, and in so doing kept nearly 70,000 miners in regular employment. As manufacturers realized more clearly the immense possibilities of gaseous fuel for industrial processes requiring heat, there would be a vast extension of the industrial sales of gas, with a consequent increase in the amount of coal purchased by the undertakings. Although in some directions the Gas Industry was the competitor of coal, yet the coal industry had a real interest in the Gas Industry because of its relationship and importance to the coal industry. It was comforting, when looking at falling returns in other directions, to reflect that gas was a steady friend.

The Oil Tax.

"A great deal," remarked Mr. Brown, "has been said and written recently with regard to the tax on heavy oil lately imposed by the Government. Figures have been quoted to emphasize the small increase in the use of oil in this country during the past few years; but it is highly significant that, at a time when the total world consumption of coal and of oil has been going down, the use of oil should have gone up at all in our own land, while the consumption of coal has dropped millions of tons in consequence of the industrial depression. If the tax turns the tide in favour of coal, then the tax will have been well worth while.

"The Government cannot view with equanimity the process which has been going on in London and other great cities during the last two or three years, by which great buildings have been going over to oil. All observers of our modern life knew that this process is going on at increasing speed, and there can be no doubt that the new duty will be of considerable help to the mining industry. The work done by imported oil could, in many cases, be carried out equally well by gas, coke, pulverized coal, or oil made from coal, and the process upon which so much time and money has been spent in an endeavour to increase the production of oil from coal will find material help in the new duty.

"I wish the gas undertaking, the Corporation, and the citizens of Lincoln the greatest possible success." [Applause.]

The Coal Mines Act.

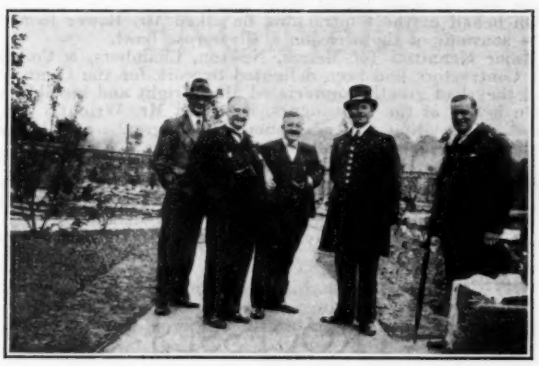
Mr. F. P. Tarratt, responding to the remarks made by Mr. Brown, said that until this gathering he had no idea that in the Secretary for Mines they had such an excellent advocate of the Gas Industry, and he had the greatest feelings of admiration for Mr. Brown's broad and enlightened outlook. It was a pleasure to him, as President of the Institution of Gas Engineers, to reply to the interesting speech they had just heard, and he would like to take the opportunity of publicly stating how much they were indebted to Mr. Brown for his presence among them, thus showing his interest in, and sympathy with, their great Industry. Until recently it had been only upon the rarest occasions that Cabinet Ministers, or even members of Parliament, had deemed it essential to show any great appreciation of the importance of the Gas Industry. It had, in fact, been hinted that with the advent of the electricity grid, the Gas Industry would no longer serve any useful purpose. Notwithstanding their regard for Mr. Brown, they could not conceal the fact that they did not altogether see eye to eye with his Department in every respect. As all were aware, Mr. Brown was not responsible for the birth of the Coal Mines Act, nor for its early upbringing, and they could not fail to feel some measure of sympathy for him in having to administer the measure. It was still true to say that the greatness and prosperity of the country must depend in the future, as it had depended in the past, upon cheap coal, and he trusted that Mr. Brown might, in the near future, consider how the Coal Mines Act could be so amended as to permit coal being economically sold at the cheapest price. Personally, in his own district, they had not much to grumble about in the matter of price, but he knew some other areas had been more hardly hit in this respect than his own.

Gas a Home Industry.

"The Gas Industry," proceeded Mr. Tarratt, "is predominantly a Home Industry, and its success and its prosperity are wrapped up with those of the country, which in our judgment largely depends upon the best use being made of the nation's natural resources. As those present are probably aware, it was for this reason that the Gas Industry lent its support to the tax upon imported fuel, in spite of the fact that it may cost the undertakings of this country over £200,000 a year. Gas is at least as convenient and effective for all industrial processes as oil, and the tax gives the Industry that extra competitive power so urgently required to-day."

He felt he must congratulate the City of Lincoln and Mr. Wright, their very able Gas Engineer, upon the completion of the reconstruction of their works. The scheme did not appear to have been considered until 1931, yet it had been already brought to fruition, and made complete in every way. In years to come the Corporation would be able to look back with pride upon the excellent work that had been carried out, and with a feeling of satisfaction that, in providing the City with a modern

plant to meet the growing needs, they had also furnished work when unemployment was rife throughout the country. He had never been round a works which pleased him more—"everying in the garden was lovely." He had no fears for the future prosperity of the Gas Industry. Providing Parliament could

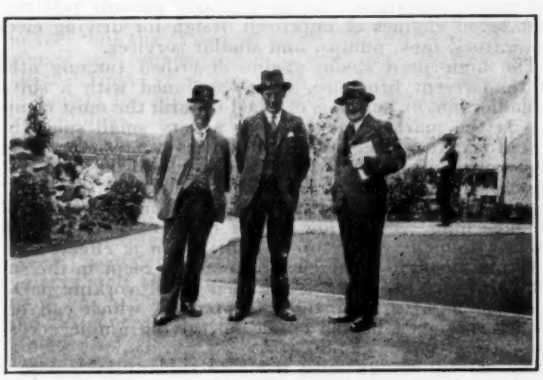


Left to right: Mr. J. T. Haynes, Rotherham; Mr. E. J. Wellens, Wombwell; Mr. W. J. Smith, National Gas Council; a Representative of the Lincoln Corporation; Mr. F. P. Tarratt, Newcastle-upon-Tyne.

see its way in the near future to give effect to the recommendations of the Departmental Committee of Gas Legislation, the Industry would not fail to play its part in the affairs of the country. He could speak on this subject from personal knowledge, inasmuch as his own undertaking—the Newcastle-on-Tyne and Gateshead Gas Company—was one of the few fortunate concerns which, by a Private Act of Parliament, had been able to relieve themselves of some of the shackles of the past. They had actively encouraged and developed the use of gas for industrial purposes, and had already achieved success, even in these gloomy days of industrial depression, to the benefit of both the Industry and the consumers. The Gas Industry could not, however, give the fullest satisfaction to the consumer without the active assistance of Parliamentary legislation. There was no industry in the country whose record as an employer of labour was as fine as that of the Industry he had the privilege to serve. The National Joint Industrial Council was admittedly the most successful of such councils—a body composed of workers' and employers' representatives to settle any disputes that might arise throughout the country within the Industry. The Gas Industry was one of the first to adopt the principle of co-partnership, which might well be emulated in other industries.

"Buy British!"

Sir Francis Goodenough (Chairman of the British Commercial Gas Association) said it was a great pleasure to add to the appreciative remarks of Mr. Tarratt his own thanks to Mr. Brown for having come all the way from London to open these beautiful works, and for having given them such an eloquent speech on behalf of the Gas Industry. He agreed with the Secretary for Mines and with Mr. Tarratt as to the future of the Gas Industry, which he believed would be very much greater than had been its past. He frequently looked at a cartoon which was published as long ago as 1879, and which depicted



A Group of Visitors,

with Mr. F. B. Richards, Chairman of the Woodall-Duckham Company, in the centre, and Mr. D. M. Henshaw, of Messrs. W. C. Holmes & Co., on his left.

electricity snuffing out gas. Well, the output of the Gas Industry now was probably ten times what it was then.

It had been remarked by Mr. Brown that in some directions the Gas Industry was the competitor of coal, but he (Sir Francis) would point out that never, then, did the miner lose his job, for whether crude coal was displaced by gas or by coke coal had to be carbonized at the gas-works, and that coal had to be won from the seam by the miner. We had all, Sir Francis added, been adjured, and many of us had promised to "Buy British;" but, when personal interests were touched, the sentiment seemed to wear very thin, and sometimes came off altogether. So, when it was sought by a tax to divert custom from foreign, imported oil to home-produced British coal and its products, a howl went up to the heavens denouncing the proposal as iniquitous and retrograde. A reduction in the imports of oil and an increase in the use of coal at the gas-works to produce gas or coke, would help the exchanges and reduce unemployment in this country. There was a more than usually good case here for "Buy British." The only thing to regret about the tax on oil was that it was not introduced several

Alderman G. Clark, Chesterfield, with Mr. G. Stevenson, of Long Eaton, on his right, and Mr. G. J. Clarke, of Messrs. Penney & Porter, on his left.

years ago. It would prove of substantial advantage to the nation as a whole, and only if it was to assist the nation would the Gas Industry wish it to be carried through.

The Gas Engineer.

The Mayor said they could not part without expressing appreciation of the work of their Gas Manager and Engineer. [Applause.] The members of the Council, and particularly the members of the Gas Committee, knew full well the value of

Mr. George Wright, Lincoln's Gas Engineer and Manager.

The snapshots here reproduced were taken in the admirably laid out flower garden which forms part of the Gas-Works site.

Mr. Wright to the undertaking and to the city generally. The whole of this work had been carried out under Mr. Wright's supervision, thereby saving a considerable sum of money to the ratepayers. Mr. Wright had spared neither time nor effort in furthering the scheme.

The Contractors.

The Chairman of the Gas Committee heartily endorsed all that the Mayor had said. He also referred to the work of the Contractors, which, he remarked, had been exceptionally good. The work had been carried out successfully without any hitch, and the plant was in commission several months before the time specified. The old plant had to be kept going while the new was being erected, and the job reflected the greatest credit on the

whole of the staff and workmen. The Woodall-Duckham Company gave out some of the sub-contracts to local firms, so that much of the work had been done in Lincoln, and since then other contracts had been placed with these firms, so that further work had come to Lincoln. In addition to the Woodall-Duckham Company, the Contractors included Messrs. Newton, Chambers & Co., Messrs. W. C. Holmes & Co., Messrs. Peebles & Co., Messrs. Penny & Porter, and Messrs. M. Otter & Co.—the last two being Lincoln firms. He had pleasure in expressing the thanks of the Committee to the Contractors.

Mr. F. B. RICHARDS (Chairman of the Woodall-Duckham Vertical Retort Company), acknowledging the thanks, said the Contractors had felt it a privilege to take part in the construction of these very fine works. It did not often happen in this country that so extensive an undertaking had to be carried through. To achieve success, the keynote must be co-operation on the part of everyone concerned; and the Engineer had co-ordinated the efforts of all in a remarkable way. On behalf of his own Company, he would like to say how much they had appreciated Mr. Wright's courtesy and helpful constructive criticism throughout the whole of the work. He congratulated the Gas Committee and the citizens of Lincoln upon the service rendered by Mr. Wright. They were indebted to the local firms who had assisted in the work, and whose material was excellent. His firm had for many years got waste-heat boilers from a local firm—Messrs. Ruston & Hornsby—who must have supplied them with at least 150 of these boilers.

On behalf of the Contractors, he asked Mr. Bower to accept as a souvenir of the occasion a silver rose bowl.

Major KITCHING (of Messrs. Newton, Chambers, & Co.) said the Contractors had been delighted to work for the Committee, and they had greatly appreciated Mr. Wright and his ability.

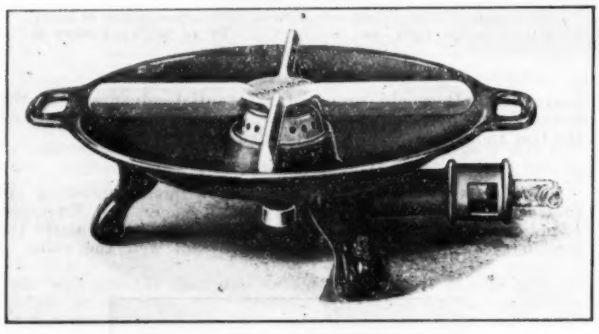
On behalf of the Contractors, he asked Mr. Wright's acceptance of a writing set and album of photographs as a token of "a job well conceived and well executed."

Mr. WRIGHT, being called upon, declared that, without the loyal co-operation of every member of the staff, and particularly of Mr. Bowden and Mr. Enright, it would have been impossible to carry the scheme through without the assistance of even an extra office boy. He expressed his thanks to the Contractors.

NOTES ON PLANT AND PROCESSES

A Novel Boiling Burner.

The accompanying photograph shows a novel design of gas boiling burner recently developed by the Parkinson Stove Company, Ltd., of Stechford, Birmingham, and displayed in their new Showrooms at Terminal House, Grosvenor Gardens, S.W. 1.



The Parkinson Stove Company's New Boiling Burner.

The interesting departure lies in the fact that the ring, from which radiate at right-angles the four utensil supports, is set in a shallow saucer-shaped bowl designed to catch and retain any liquid which should happen to boil over. The fitting is attached from underneath the bowl to the gas supply in the normal way by means of flex tubing, while it has the advantage of not having to be placed on a hearth when in operation. The utensil supports are finished in aluminium paint, while the bowl is supplied in silver-grey mottled enamel finish and in various colours.

Our illustration is self-explanatory, and it is understood that the appliance is already creating a considerable amount of interest in the Industry.

The Kent Shunt Meter.

This type of meter, made by Messrs. George Kent, Ltd., of Luton, is the outcome of thirteen years' development. Primarily designed for use as a station gas meter, it can, on account of its ready accessibility, be successfully used for the measurement of dirty gas.

A high degree of accuracy, long life, and large range of registration have been obtained by keeping the speed of the turbine low, which is accomplished by means of damping fans, by taking the weight off the bottom pivot by floating the rotating part in mercury, and by running the counter-mechanism in an oil bath. A magnetic gland isolates the counter-gear, and prevents the escape of gas and the condensation of moisture on the dial-glass.

Being only 24 in. long, the meters are very compact, and each meter, irrespective of size, is standard with the exception of the body casting, the orifice plate, and the counter-changewheels. This facilitates the fitting of spare parts where a number of meters are in operation. It may be added that all the essential parts of the meter can be inspected without taking the body-casting out of the main, as large hand-holes are provided both on the body and on the fan chamber. The nozzles through which the gas discharges are arranged for easy removal, so that they can be readily cleaned when necessary outside the meter. When measuring clean gas one inspection per annum is ample, but when dirty gas is being dealt with, the nozzles are inspected and cleaned once a month, or as often as may be found necessary.

For measuring dirty gas, steam jets can be provided, operated without disturbance of the meter. An important feature is that no correction is needed for variation in density of the gas, as measurement of the actual volume of gas passed is recorded. Independent tests taken against the drum type of station meter show that the Kent shunt gas meters run with absolute consistency, and that the difference in the weekly readings is of the order of 0·2 or 0·3%.

As to the overall loss of pressure, at full flow it amounts to about 1·5 in. W.G.; at 100% overload, 6 in.; and at half flow 0·4 in. W.G. Standard shunt meters are suitable for pressures up to about 5 lbs. per sq. in., but special meters for pressures up to 50 lbs. per sq. in. can be made.

Sisson High-Speed Engines.

The latest catalogue of Messrs. W. Sisson & Co., Ltd., of Elmbridge Road, Gloucester, describes and illustrates the firm's high-speed steam engines, with notes relating to the leading features of their design and construction.

The firm is an old-established one, for, in 1889, Mr. William Sisson went to Gloucester to take over a small engineering works in the city, where he had the assistance of his brother, Mr. Arthur Sisson. Both these gentlemen are members of the Institution of Mechanical Engineers. The works increased, and, in 1904, a site was purchased outside the city, new works built, and a Company formed to develop Mr. William Sisson's various patents in relation to marine and launch engines, engines for tin dredges, pneumatic elevators, and particularly patents relating to high-speed engines of improved design for driving electric generators, fans, pumps, and similar services.

The high-speed steam engine described (among others) in the present brochure, when combined with a suitable dynamo, fan, or pump, is claimed to form the most compact set on the market and occupies a very small space for a given output. The patent automatic expansion and compression crankshaft governor secures close speed regulation under all conditions of load, and the whole is totally enclosed and automatically lubricated. The makers' system of governing secures low steam consumption under wide ranges of load, while forced lubrication is effected to all working parts by a valveless oil pump, except in the smallest sizes. Accessibility is obtained to all working parts by a special light and oil-tight front door, which can be instantly removed in one operation, giving ample access to the interior of the engine.

By careful design with few and substantial parts, particularly in the governor, long and continuous running, low maintenance cost, and ease of adjustment are obtained. The design and material used make the engine suitable for high steam pressures and all temperatures of superheat in general practice, while engines can be arranged for the utilization of exhaust steam, with non-lubricated cylinders, providing an exhaust entirely oil free. As a result of producing in large quantities and of standardization, the firm are enabled to supply completed engines from stock, together with spare parts without delay.

The brochure describes and illustrates, also, the firm's patent compound engines, marine and dredge engines, &c.

INSTITUTION OF GAS ENGINEERS

Written Contributions to the Discussions on the Papers at the Meeting in Liverpool, June, 1933

Heating Buildings by Gas

By ARTHUR H. BARKER, B.Sc., M.Inst.C.E., M.I.Mech.E.

Mr. W. E. BENTON (Cannon Iron Foundries, Ltd.) writes: My comments on Mr. Barker's Paper refer only to Section IV. Mr. Barker is an acknowledged authority on the subject of heating, and his publications are always read with interest and pleasure. I would suggest, however, that in his treatment of the gas fire, he has omitted an important factor. He enumerates (p. 25) three essential qualities of a perfect fuel—(1) it should be mobile; (2) it should be safe; and (3) it should be easy to ignite. In the heating of public buildings these qualities may suffice, since the owner of the building is concerned primarily with questions of cost, or, shall we say, efficiency; and the more subtle qualities, such as the " Attractiveness " of the method of heating to those experiencing it, do not seriously concern him.

In his remarks on the gas fire, Mr. Barker has, however, represented the opinion of the general public, which, of course, refers to domestic heating, where the person who experiences the heat also pays for it. In domestic heating, I would suggest that a fourth quality is essential, " that the form of heating should be acceptable to the consumer." It is not enough that an appliance should give the consumer the maximum amount of heat for the least money; it should also give him pleasure. England is a country of mild winters. Extreme cold is very seldom experienced, and often a cold morning may give place to a warm afternoon.

Central heating, as employed in America, is of little value here. The demand is for an intermittent method of heating, coupled preferably with some resemblance to an open fire. The efficiency of the present gas fire may possibly be improved. The distribution of heat can be improved—*e.g.*, by inclining the radiants—and the quality of their heat can to some extent be improved by altering their composition. Moreover modern gas fires undoubtedly meet with the public approval. Many of us believe that a source of high-temperature radiant heat is more beneficial to health than one of low temperature. Taking the various factors into consideration, I do not foresee any great success attending the introduction of low-temperature heating into domestic houses in England.

LOCALIZING BOILER PLANTS.

Mr. T. F. C. POTTERTON (Thomas Potterton (Heating Engineers), Ltd.) writes: The local use of gas for heating is obviously the great advantage this fuel possesses over oil or solid fuel, but the extent to which this can be carried with efficiency and convenience is in most cases limited, and in no way detracts from the much more general use of gas-fired boilers for hot water supply and central heating in large buildings.

Great advantage can be taken of gas by localizing boiler plants, particularly where numbers of isolated buildings constitute one establishment, as in the case of many modern hospitals. This method dispenses with large mains, while those within the buildings are often useful as heat transmitting surfaces, thus greatly reducing the loss between the boiler and the heat in the room, mentioned in the Paper and shown as such a considerable loss on the chart of fig. 2.

The gas generator method is described (pp. 18-20), but it is stated that special and expensive construction of the boiler chamber is required. It may not be generally known that the manufacturers of this plant have now made a special type of equipment similar in principle but of horizontal pattern for application to any existing boiler plant, and this must be considered as an automatic coke stoker of the highest order, additional equipment being added to make it almost as automatic as oil firing at a much reduced fuel cost.

Oil is compared with gas as a boiler fuel (p. 20), and it is finally stated that gas is more dangerous on account of its more ready combustibility. While this may be so as fuel to fuel it cannot be so in practice. Oil fuel has to be stored on the premises and is always a potential danger " in case of fire " when it would gasify if overheated. This is demonstrated by the objections the Fire Brigade Authorities raise to the storage of oil fuel within the fire danger zone of London, although this objection is sometimes overruled. Electrical power is also generally used for oil firing and the risk of fire from this source has to be added to the account of oil fuel. In addition, the high temperature of flues and chimneys with oil firing must not be overlooked; so that taking all factors into account gas cannot be considered more dangerous than oil as a boiler fuel.

THE RAYRAD.

With regard to Section V. of the Paper, I was particularly interested to know of the considerable advance that had been made in the gas-heated Rayrad, as my Company was associated with the earlier experiments of this system and had its own offices warmed by an installation comprising ten such Rayrad units with mechanical extraction. These were sufficient to show the possibilities of such a system, but this was in the early experimental stage about five years ago, and its present application to gas ovens and gas water heaters are to me quite novel features.

Upon the question of charges for gas many will be interested in the figures given, as the price at which it is considered gas can compete with other fuels is within the scope of the charges of many Companies; even in the suburbs of London some of the Companies are willing to offer gas at 4½d. to 5d. per therm for central heating where taken in large quantities. It would, however, be a mistake to consider gas as a competitor with coke, as it is felt that it must always be the policy of gas undertakings to adjust the price of the two fuels to create a demand for each in proportion to the amount produced.

With regard to electrical auxiliaries (p. 37), it would not be considered good policy for any gas engineer to be prejudiced against the use of electrical power for maintaining combustion or for purposes where it can be used to advantage, seeing that the additional cost can be more than covered by increased efficiency obtained from the gas. We must not, however, lose sight of the fact that one of the great advantages of gas over oil fuel is the simplicity of the apparatus required for its use, and the high efficiency that can be obtained without the assistance of mechanical power.

My own house is heated by a gas-fired boiler in an external heating chamber through a standard form of low-pressure hot water circulation with radiators, and I have made a very careful experiment covering the last six winter months. Air distance control is fitted in the hall, together with a recording thermometer, while maximum and minimum thermometers have been placed in all rooms, a recording thermometer being in the garden. Readings have been taken three times a day, and these, together with records of maximum and minimum thermometers, set out in graph form show a steady internal temperature which did not fluctuate more than 2° plus or minus.

The house has a capacity of 19,000 c.ft., and it is found that the maximum hourly consumption over any given twelve hours is 121 c.ft., representing 6·3 c.ft. of gas per 1000 c.ft. of space, while the average over six months, November to April, is only 48 c.ft. per hour, equalling 2·5 c.ft. of gas per 1000 c.ft. of space. These figures are very close to those mentioned in connection with gas Rayrads, while in this instance no electrical power is used, the heating units being standard floor model radiators.

If it had been permissible to fit Rayrads on the walls with water circulation from the central boiler, no doubt even more economical results could be anticipated, although their application would present some difficulty owing to the decorations and limited amount of wall area available.

At the house in question the air thermostat which is situated in the lounge hall is set at 58° F., any supplementary heat required being obtained by the use of a gas fire in the occupied room, which, however, is only used to raise the temperature above 58° F., all up to this degree

being done by the central heating boiler. The air thermostat, being in the hall, is in no way affected by the gas fires, and has the advantage for this purpose of being constantly in the shade.

The gas fires being on the house meter do not count in the running cost of the heating system referred to, which is separately metered. It is extraordinary how noticeably comfortable a house is at 58° F. to 60° F. when warmed throughout during the winter months, the staircase and landings being uniform in temperature with the other parts of the house. The radiator system contains 400 sq. ft. direct heating surface in seventeen units, including the kitchen, bathroom, and garage, and works at an average circulating temperature throughout the winter of 100° F. This induces " comfort warming " devoid of any feeling of dryness or " stuffiness " so often objected to, and demonstrates the advantage of adequate heating surface.

It will be noted that this is not a laboratory test, but taken under the normal winter conditions in an occupied house.

THE AUTHOR'S REPLY.

In common with my critics I regretted very much the limited time available for the discussion at the meeting. The paper indeed was expressly designed to provoke discussion on the crucial points of difference between the layman and the gas expert, expressly with a view to the further enlightenment of the author himself. A discussion on such a paper is not infrequently more valuable than the paper itself; the value of the paper often depends on its power of provoking a discussion from those who are probably better qualified to speak on the subject than the author himself.

Mr. Stephen Lacey called attention to my partiality for heating buildings by what may be called the " panel " method. I confess to that partiality because I know from much experience that it not only procures a much more comfortable and hygienic result, but is also immensely cheaper in fuel than the more common method of heating by convection. In my search for the ideal means of using gas I naturally incorporated what I generally regard as the ideal method of heating the room with the best fuel available for the purpose, which in my view is unquestionably gas, when all things, including price, are taken into consideration.

Mr. Lacey accuses me of grossly under-estimating the part played by the gas fire in the heating of buildings. My personal opinion of the gas fire, if it is of interest, may be judged by the fact that I have a gas fire in every room of my own house, together, of course, with panel heating for the dissemination of general warmth.

It will be judged that my own view of the ideal method of heating is that the " effective temperature " should be raised to a tolerable degree by means of panel radiation, supplemented for those rooms actually occupied by visible radiation from a gas fire as the most convenient combination for procuring both heat comfort and psychological comfort.

Mr. Lacey takes perhaps too literally my statement that if the gas fire had been a solution satisfactory to the public the use of gas fires would have extended twenty times more rapidly than has been the case. That figure may perhaps be explained as a rhetorical exaggeration. The fact remains that when an ordinary commercial architect is putting up a commercial building in a city he not only does not adopt gas fires for warming it, but he does not even consider their adoption. If a consultant were to be so unwise as to suggest that method to an average architect, he would be written off as a person whose advice was of no value.

If that statement is, as I think, incontestable, it surely shows that the gas fire is not the solution for which the public are consciously or unconsciously in search. The public wishes to come into a warm building without being conscious of where the heat comes from. The occupants of an office want to be kept warm all the day without being conscious of the heat at all, just as a really healthy man goes through life without his possession of a liver, or lungs, or kidneys, or any internal organs being forced upon his notice at all. If they are all working properly he cannot feel them and does not notice them.

Mr. Lacey surely stresses unduly my observation that one outstanding disadvantage of gas is the necessity for keeping it closely confined in a gas-tight pipe. It is quite true that a gas leakage ought not to be and is not a frequent occurrence in a house, but if a serious gas leak *does* take place it may be a very serious matter.

A serious leakage of electricity blows the fuse and calls very pointed attention to itself by automatically turning out every light in the house; alternatively, it may give the occupant what is facetiously termed " a packet," or a shock, if and when he touches a live switch. In certain circumstances, of course, such a shock may prove fatal, but general experience shows that in the ordinary electrically lighted house such an experience is very rare. I do not remember that in all the years of my life I have ever experienced one. Similarly a gas leak might call attention to itself by leaving an unconscious form prostrate on a bed, or by generating a disastrous explosion.

Although all these accidents are, happily, rare, it does not strike me that it is good policy on the part of the Gas Industry to challenge a comparison with electrical energy on the basis of the relative disadvantages of leakage.

I am sorry if I made a mistake in the statement that it is not very easy to burn gas so as to produce no carbon monoxide and no hydrocarbons. I have personally made many experiments on the composition of products of combustion of gas by the delicate iodine test. I have very rarely been unable to detect *some* carbon monoxide.

Though it may be, and is, true that many flueless heaters are daily operating with perfect satisfaction to the people using them, I have very good reason for knowing that many flueless heaters are also working which have *not* given satisfaction to their users, because I myself have been instructed frequently to remove them from throughout a building and to replace them by another method, which does not emit products. That the flueless gas stove does satisfactorily fulfil certain requirements I am well aware, and in some situations it is entirely satisfactory to the user, but I challenge Mr. Lacey himself to say, if he were instructed to fit up an office building with appropriate heating appliances which should satisfy the bulk of the people who were to occupy it, that he himself would propose a general system of flueless gas heaters. Alternatively, does Mr. Lacey use flueless gas heaters in his own house? I ask that question without the remotest idea of how Mr. Lacey's house is heated.

I do not believe that 5% of the members of the Gas Industry would themselves propose flueless gas heaters for warming their own houses, although this is, as I well know, one of the most inexpensive methods of providing the necessary heat for an intermittently used room.

If I were in the Gas Industry I would not be satisfied until I could produce a method of heating by gas which is not only equal in a technical sense to any other method, but also cheaper on the whole both to install and to maintain. I do not think anybody could claim that any form of flueless gas heater is the equivalent of, let us say, electrical heating. The Gas Industry ought not, in my humble opinion, to sit down with a confessed inferiority of result. It ought to be able to say, " we can produce the best *and* the cheapest," which can be done if the right methods are adopted; but, for reasons stated, the flueless gas heater is not the right method.

The flueless gas heater has, and always will have, a certain market, but it cannot have the universal market which gas ought to aim at. A system of heating by gas ought to be brought into such a position that every architect and every owner will weigh its merits against every other form of heating in every building erected. Gas has not that position to-day, and it never will in my opinion as long as the flueless gas heater and the gas fire are the only methods proposed by the Industry.

It is quite true, unfortunately, that the first cost of an ideal installation of heating by gas is, and is likely to remain, much higher than heating by flueless gas stoves, just as a Rolls Royce is, and is likely to remain, much dearer than a Morris or a Ford. If Rolls Royce, Ltd., could combine the virtues of their own product with the price of a Ford they would sweep the market clear. That, I believe, is what the Gas Industry could do if they would tackle rightly the problem.

It is quite true that the ventilating virtues of a gas fire are valuable, but the ventilation of a room can be effected much more cheaply by an electrically driven fan than by waste heat from a gas fire.

In reply to Mr. G. B. Howarth, I have also found the method of delivering air under pressure from a blower to be quite satisfactory as far as it goes, but the difficulty is that it is not always possible to evacuate the products into the open air at a suitable point. In any case, the continuous provision of compressed air involves the use of additional auxiliary apparatus.

On the installation as proposed, any failure of the apparatus would at once shut down all the gas, and electric motors are at the present time so reliable that they frequently run for many years without any sort of attention.

I have found no difficulty in equalizing the suction at the numerous " gasrads " in a large installation. The same problem would, of course, be presented by a system of vacuum cleaning.

In reply to Col. W. M. Carr, it is impossible to produce a statement of relative costs which would be universally applicable, in view of the large differences in the cost of both electricity and gas in various parts of the country.

As he says, the Wollaston boiler does in some cases in-

volve a good deal of labour, and for that reason it is only applicable to comparatively large installations where the employment of a full-time stoker in constant attendance on the boilers is possible. The economy produced by the correct use of this boiler is quite extraordinary.

The comparative particulars of cost which Col. Carr gives are very interesting and go far to confirm my view that at a price of 3d. or 4d. per therm gas definitely comes into the picture even as a boiler fuel. Indeed, if the Gas Industry can so alter their method of production as to reduce the actual cost, I believe, as stated in my paper, that gas as a boiler fuel would be a very prominent feature in installations of the future, but certainly not above the price of 4d. per therm.

Replying to Mr. C. S. Shapley, I have looked up a copy of the Report I made some time ago to the City of Leeds, on the basis of which gas was adopted as a fuel for the New Municipal Buildings, and do not see anything inconsistent with the present paper, although the two were written quite independently.

Mr. T. F. C. Potterton is probably one of the most experienced persons in this country in the adaptation of gas as a fuel for heating purposes, and I quite agree with the greater part of his criticism. It is unfortunately only too true that many gas engineers are very heavily prejudiced against the use of electrical power for any purpose, even in increasing the efficiency of the use of gas.

I venture to consider this attitude a wrong one. In my experience it is always the case that the judicious application of a little electrical power can increase the efficiency of gas so much that the consequent saving is enormously greater than the trifling cost of the electrical power.

Mr. Potterton's description of the apparatus in his own house might well be taken as a model for other people using gas to the best advantage in a domestic establishment.

Mr. W. E. Benton's contribution is also interesting. It is quite true that the attractiveness of a method of heating is a great point in favour of gas when it is used in a suitable gas fire. Many gas fires in my experience are, however, very distinctly unattractive to myself. There are some which are an almost perfect imitation of a coal fire; indeed, I have frequently been in a room heated by fires of that sort when I was myself actually under the illusion that the fire was a coal one.

The principal difficulty is that when turned low the illusion is dispelled, and any person who could devise a form of gas fire which would be similar in appearance to a coal fire at all rates of combustion would speedily make a very large fortune.

The value of the gas fire during the summer has frequently been referred to by myself. The difficulty in its use is that, while one commonly wants a fire in summer evenings, the usual type of gas fire gives off so much heat that it is positively uncomfortable. We badly need a fire which will have a good appearance when it is giving off very little heat.

I am quite in agreement that high-temperature radiant heat is in many cases beneficial to health, but it is certainly not adaptable for the ordinary commercial building, and it is in this regard that gas fails.

Knowing as I do well the success which has attended the use of low-temperature electrical heating in multitudes of houses in this country, I cannot agree with Mr. Benton that gas used in the same way is not likely to attain great success. If I were myself designing a heating apparatus for a house exactly according to my own ideas I should use low-temperature gas heated units for the purpose.

The Development of Gas as an Industrial Fuel

By JOSEPH E. WHITE,

Newcastle and Gateshead Gas Company.

Mr. J. H. CLEGG (Burnley) writes: I agree with the Author's three essential features for the success of universally establishing the Industry's business, but in respect of (2) "Charges for Gas," uniformity of method throughout the country is required. I am surprised that the recommendations of methods for charging contained in the National Gas Council report have not been more generally adopted. We have had in operation with conspicuous success for a period of three years, the four-part system based on the allocation of accounts laid down therein.

I am convinced that a multi-part charge is a necessity for meeting competition in industrial and commercial gas development. Block charges based on quantity do not meet the varying conditions met with in the particular types of load, and in respect of fixing a charge to all consumers of a particular trade where a lower price is necessary to compete with the other fuels, a standard reduced commodity charge for this business meets the situation. A two-part charge is desirable for domestic business.

Gas for use in internal combustion engines is a subject of vital importance to us, and in my opinion not sufficient interest has been displayed in the retention of this business either by gas undertakings or engine manufacturers during the past ten years. I have told gas engine makers that if they had utilized anything like the quantity of brain power in the development of gas engines that they have used in the interest of fuel oil engines, we should be in a very different position in our power market to-day. The engine makers retort that when the majority of gas undertakings require about 3s. to 3s. 6d. per 1000 c.ft. for their gas, gas engines were not worth considering, as their competitors would offer oil engines which used a comparatively cheaper fuel. There is probably a great deal of truth in both arguments.

The Author mentions the installation of a 6-cylinder Buick engine, high speed, and to generate electricity, which consumes 22 c.ft. per B.H.P. hour. This figure does not appear low even in relation to the consumption on a three or four cylinder vertical gas engine of the old low-speed type. In any case, to use 11,000 B.Th.U. per B.H.P. or about 16,500 B.Th.U. to produce 3412 B.Th.U. in the form of one electrical unit generated is low in efficiency, and it is obvious that considerable scope for improvement lies in this direction.

A few months ago we were successful in securing the supply of gas to two 135-H.P. engines for electrical generation, and in obtaining tenders for the supply of those engines one maker guaranteed to supply high-speed four-cylinder engines of about 850 r.p.m. to generate with a consumption of 12,500 B.Th.U. per KW. hour. Although this firm are reputable makers of oil and gas engines, the nearest high speed engine of this type they had installed was in Africa. All the other makers required from 14,000 to 16,000 B.Th.U. per KW. hour, and I had perforce to advise our customers to accept one of the low-speed engines.

I have often thought one of the Councils representing our Industry might consider ways and means of raising a fund to offer substantial prizes for improvements in the development of prime-movers by gas, particularly as we are now interested in the use of gas for the running of vehicles. The Author's report on this subject, while very interesting, leaves one to feel that we have not yet made the progress which was anticipated twelve months ago in this direction. Time is an important factor, and who knows but that the Gas Industry may, if ready, play its part in the future of railway transport.

A DIFFICULT TASK.

Mr. A. MACKAY (Stoke-on-Trent) writes: I wish to congratulate Mr. White on his Paper on Gas as an Industrial Fuel. I always have a considerable respect for anyone who comes forward, particularly to a body of technical men, and gives his experiences in connection with this important and difficult question. The record of work given, general information, and photographs, and also forms for use for industrial purposes, reflect very great credit on Mr. White in connection with this whole question.

One wonders, having regard to all the activities of his Company, what is likely to become of that old adage sometimes used—namely, "taking coals to Newcastle." We must always recognize that having the coalfields surrounding them the task of pushing industrial fuel must be a difficult one.

I very heartily agree with him in his observations regarding the capabilities of a staff for the controlling of Industrial Departments. Their qualifications are certainly very difficult to define, and it is well-nigh impossible to get any selection of specialized experience in the basic industries of our districts together with a sound technical training.

The paramount considerations in pushing town gas for industrial purposes are:

(1) The selling price of gas.
(2) Thorough knowledge of the application of gas to the particular industries of one's own district.

In my own case where we are specially interested in town's gas firing for the pottery industry, it is very necessary that not only should we have a thorough knowledge of the application of heat, but also of the actual material which we intend treating.

When I first of all set out on this work I had the erroneous idea that the introduction of suitable furnaces was all that was necessary, but the early days of ordinary laboratory experimental work soon eradicated from my mind that the problem was an easy one. Not only must we make ourselves familiar with the actual body of the material to be fired, but also with the different glazes and decorations. We therefore found it very necessary that we should have a well-equipped Demonstration Room showing, under practical working conditions, the different appliances for which town gas was most suited.

Gas in the Pottery Industry.

The activities and research work carried out by my Department into the uses of town gas for the various heat treatments required in the pottery industry may be well-known to some of you, but it is of more than passing interest to point out that town gas is being successfully used locally for the following processes:

Porcelain firing, tile firing, earthenware firing, core drying, colour drying, clay drying, tank heating, chemical works processes, clay press heating, roller heating, potters' printing, and steam raising.

Experimental compressing plant for gas driven vehicles is in course of erection. Our main products, however, are earthenware, tiles, sanitary ware, electrical, and other porcelains, dinner ware and china.

Pottery making is an ancient industry, and although in the course of time the products of the industry have been improved beyond recognition, the methods of firing have altered really very little during the last 50 years. That they have remained unaltered is not attributable to any excessive conservatism on the part of the great industry; rather it is due to the fact that the effects of heat on clays are still only imperfectly understood, or, as is said locally, pottery ware is "fickle in the fire."

Developments which have taken place over a period of six years are likely to prove an important factor in ensuring

(1) The superiority of the British made article.
(2) Definite reductions in manufacturing costs.
(3) Considerable decreases in the proportion of rejects and second-class ware.
(4) A much more rapid completion of orders.

Comparative Costs.

In attempting to arrive at a comparative cost of town gas and any other fuel, it is necessary to take into consideration the "all in" costs of production, and not simply the cost of fuel. In most cases it will be found that the use of town gas as a fuel effects considerable indirect savings, and often a more complete investigation into the economies of a particular heat treatment operation will make it quite apparent—having regard to the all-in costs of production—that town gas is more economical, and offers many advantages.

For instance, it will be obvious that as the bulk of the oven space is occupied by protective material, a large proportion of the heat is also taken up by that material, so that the efficiency of the firing operation in relation to the amount of ware treated is exceptionally low. The efficiency of the intermittent type of solid fuel fired kiln is in the region of 5-10 per cent., and the speed of the heating operation is also of a low order.

With the gas-fired oven the use of saggars is in many cases rendered unnecessary. (For your information I should explain that a saggar is an oval shaped receptacle about 10 in. deep, built up of refractory material, into which the ware is built solidly by packing around it sand. These saggars are built up one above the other in the oven. It will therefore be obvious that to penetrate this mass of material increases the fuel costs very considerably.) With a view to abolishing saggars, it is necessary that bats and props should be used, which have a much longer life and cost considerably less in proportion to the total amount of material they can support during their life.

Other and much more important advantages, however, accrue from the use of bats and props instead of saggars. These advantages include:

(1) The weight ratio of bats and props to ware has been reduced to 1: 1, as compared with 10: 1 ratio when saggars were used, and much more ware can be fired at one time in a given oven space.
(2) Considerably less fuel is used in heating up the light supporting material than in heating a saggar.
(3) The ware is heated more uniformly, accurate temperature control throughout the working space being relatively simple.
(4) The ware is heated more quickly.
(5) The goods are not discoloured as was sometimes the case when they were packed in sand.
(6) By the adoption of gas firing, coupled with the use of bats and props, the two firing operations (involving two loadings and two unloadings) which were necessary when solid fuel was used have been carried out satisfactorily in one stage.

These advantages alone would justify serious consideration of the question of substituting gas for solid fuel firing, even if the fuel costs of gaseous firing per article produced were higher than those of coal firing.

In a particular factory where electrical porcelain goods are mainly produced, coal-firing costs amounted to about 7½ per cent. of the selling price of the articles, since the introduction of one stage gaseous firing by town gas the firing costs have been reduced to about 4½ per cent. to 5 per cent. of the selling price.

This result is due not only to the high efficiency of the gas-fired oven (about 30 per cent. compared with about 5 to 10 per cent. in the case of the coal oven), but also to the fact that the number of "rejects" has been reduced by at least 50 per cent., and the proportion of first quality ware increased.

Speed of Operation.

While recognizing all these advantages, it is pointed out that one of the most important results achieved is the considerable shortening of time now taken in executing an order. Pottery goods are not as a rule made for stock, but to order. Much may therefore depend on the speed with which a batch of goods may be made and despatched. To-day, by the use of a gas-fired oven an order for goods can be completed in three days. With the older methods (involving double firing, loading and unloading, longer time taken for each firing, and the necessity of making slightly larger quantities of goods to allow for "rejects") up to 14 days was frequently taken to execute a similar order.

Our activities heretofore referred to have principally been carried out on an intermittent oven fitted with double regenerators built under the floor of the furnace, these being of exceptional efficiency and the maximum amount of heat being abstracted from the flue gases and returned to the heating chamber in the form of highly pre-heated air. A small electric motor supplies the necessary air for combustion, and the predetermined quantity of air is passed through the furnace which is maintained at a slight pressure, and this plus pressure assists in maintaining the entire working space at a uniform temperature.

The gas is fed to the furnace by means of six burners on each side of the furnace. The burners enter the brickwork of the furnace and terminate with a refractory burner block just below the hearth. The air is fed through the regenerators and enters the working space immediately below the burner blocks, thus mixing with and carrying along the gas entering by way of the burner blocks. After working one side for a pre-determined time the process is reversed and the flame crosses over to the opposite side. This process goes on until the firing is completed. This particular furnace is used for the firing of tiles, and colour glazes on electrical porcelain ware with entire satisfaction.

Our energies lately have been directed to the introduction of tunnel ovens with travelling baskets containing the ware. It should be explained that these ovens are usually from 150 ft. to 200 ft. long, and anything from 10 ft. to 15 ft. in cross section.

It should be understood that before any pottery ware is plunged into the heating zone it is absolutely imperative that the moisture should be entirely eliminated. With this in view the waste gases from the combustion chamber itself, which is situated exactly in the centre of the tunnel oven, are carried by means of a chimney or fans to the ingress end of the tunnel, so that as the ware passes through this comparatively low temperature the moisture is entirely driven off before it enters the furnace. The outlet end of the tunnel is used for cooling the ware, a process which is as important as the drying.

The most outstanding advantage in connection with the tunnel oven is the fact that the temperature can be maintained for whatever period is desired, and so long as there is sufficient ware being prepared to feed the oven we are very hopeful that this method will result in a very considerable economy on anything we have been able to do in connection with other furnaces referred to.

We are so confident of the success of this that we have decided to lay down one of these furnaces at any factory

the Pottery Association may determine, the cost of which will be shared by the builder of the oven and my Department.

Our reason for suggesting that this tunnel be placed at a factory is that we can ensure a continuous experiment being carried out which will enable us to estimate more accurately details as to its advantages as compared with those which would accrue if the tunnel were placed in our ordinary industrial laboratory.

Iron and Steel Industry.

Mr. A. Allen (Manchester) writes: I should like to ask Mr. White the following questions concerning the iron and steel industry. Under the heading "Producer Gas" in Table IV., Mr. White gives the combined cost of repairs to furnaces and gas producers. Can he give the cost of repairs to furnace alone, and if so, does cost include repairs to silica bottom?

Can Mr. White say if the reduction in loss of steel by oxidation has been of any benefit to the silica bottom?

I note that less power is required to drive the rolls when rolling strips and plates from slabs reheated in town gas fired furnaces. Has this resulted in less roll turning, and sizes being rolled truer to gauge? In cases where steel is not annealed after rolling, does Mr. White know if the more thorough heating, with consequent easier rolling, of slabs or billets re-heated in town gas fired furnaces has made any noticeable difference to the tensile and elongation properties of the finished product?

Further Outlets for Gas.

Mr. P. Lloyd (Gas Light and Coke Company) writes: May I begin by complimenting Mr. White upon his Paper and expressing my admiration of the size of the installations he has described? He has made out an excellent case for the use of town gas in certain heavy engineering processes at the low prices which the Newcastle-upon-Tyne and Gateshead Gas Company is able to charge. There are many districts, however, where these favourable prices are not obtainable and I need, therefore, make no apology for raising a few technical points regarding the efficiency of the processes described and the possibility of developing further outlets for town gas even at considerably higher prices per therm.

I notice, for instance, that in describing his big bread-baking installation, Mr. White mentions the figure 600 c.ft. of gas per sack of flour. It would be interesting to know whether this represents the best results obtained, for in London, using ovens of the Cox heat trap type, we have already obtained figures of the order of 400 c.ft. per sack and are aiming at a figure of 300 c.ft. per sack. It is also rather surprising to find in the figures given for carburizing that the estimated efficiency of the electric furnace works out about three times that of the gas furnace. Surely that proportion would be capable of improvement, and in this connection I cannot help asking Mr. White on what grounds he takes the cooling curve of a furnace as a criterion of its efficiency (p. 18).

Returning to the enumeration (p. 15) of the advantages of town gas, I should like to add to the list a couple of points which appear to have been omitted, perhaps because they have come to be taken for granted. These are:

(i.) The ability of town gas to give an infinitely adjustable output of heat which can be increased or decreased at will, in contrast to the oil flame which becomes unstable below about 40,000 B.Th.U./hour.

(ii.) The fact that the products of combustion of town gas are innocuous in character, having for instance a very low sulphur content so that they can safely be brought in contact with the vast majority of industrial materials. Moreover, in spite of the intrinsically high flame temperature these products of combustion can readily be applied to very low temperature work by dilution with air or by similar means.

A great number of existing and I think of future applications of town gas depend upon these properties, as for instance most forms of convection heating and drying work.

Inefficient Drying Processes.

It is significant to note that drying processes in particular are still being carried out in many industries by highly inefficient means, so that it is possible, by utilizing the modern drying technique in which increasing stress is laid on air movement rather than temperature, to develop many new outlets. On the Gas Light and Coke Company's area, for instance, Mr. Dieterichs has recently erected a large number of direct-heated drying installations for products such as sago flour, soda crystals, accumulator plates, furs, squill bulb, &c., and also indirectly heated installations for puffed wheat, puffed rice, celluloid film, plated parts, gas mantles, loud speaker cones, and similar articles. I would suggest that the growth of the industrial gas load is to a considerable extent bound up with developments of this type.

Mr. White has mentioned automatic control as being a feature associated with town gas, but it is necessary to point out that it is by no means a monopoly of ours, other fuels, and in particular oil and electricity, can be subjected to very effective temperature control. The advantage of gas would seem to be that it can be controlled much more easily than its competitors. The same degree of accuracy can be obtained with gas using the expansion tube thermostat up to 1000° as with electrically operated control panels which are more complex and more costly. It is interesting also to observe what a marked effect such methods of thermostatic control may have on the efficiency of the appliance. I would mention two cases in particular—one a set of tube furnaces for treating wireless valve parts on which with automatic temperature control a saving of £5000 per annum in coal gas and hydrogen was obtained; the other a water boiler on which the provision of automatic control approximately halved the consumption of gas.

Prof. John W. Cobb, C.B.E., B.Sc., F.I.C. (Leeds University): Mr. White's interesting paper forms one more unmistakable indication of the newly developed interest in the possibilities which lie before the Gas Industry in extending the use of gas for furnace heating. The requirements are very varied, and the claims of coal gas have usually to be considered side by side with those of other fuels such as producer gas, oil, coal itself, and in some cases electricity.

The proper consideration of the problem as it presents itself in any particular case, and the presentation of results in a convincing manner demand a thorough knowledge of the principles and practice of combustion technique, along with personal qualities and alertness of mind. A new field is thus opened for the gas engineer of to-day, making wide and searching demands on his scientific knowledge.

Mr. White has dealt in an interesting manner with a number of applications of coal gas, and has shown how its special qualities come to justify its use in many operations on the score of fuel economy, output, and lowered maintenance costs, arising from the possibilities which so clean and controllable a fuel presents for scientific precision, both in design and working.

There is one aspect of this matter which is important for both its direct and indirect consequences, and that comes from the influences exerted in so many processes by the character of the gaseous atmosphere in the furnace used for heating purposes. This importance arises in many ways, but we have been studying it in the laboratories of the University of Leeds during the past eight years in connection with the scaling of metals, which is a constant source of loss in heating processes, representing annually an enormous sum when the widespread nature of this process is taken into account. In this work, the scaling effect of different neutral furnace atmospheres has been carefully and quantitatively ascertained, and the influence of free oxygen on the one hand and reducing gases on the other. That even a neutral atmosphere will cause scaling has been clearly demonstrated, especially if it is rich in water vapour, and a practical application of this principle has been made recently by the Sheffield Gas Company in a furnace designed to secure a lowered content of water vapour in the atmosphere surrounding the heated metal. It has, too, been shown—and this is important as combating a prevalent mistaken notion—that there is no virtue in a smoky flame as such for the prevention of scaling, the absence of oxidation being proved due to the reducing gases present and not to the free carbon or soot.

Another subject of primary importance which has not been investigated in this country before with the thoroughness which is essential, although work has been done upon it in America by Murphy, is the influence of sulphur compounds. This influence requires ascertaining, both with reference to scaling and with reference to the metal itself. It need hardly be pointed out that the sulphur content of a furnace atmosphere prevents very wide variations with different fuels and with coal gas itself. There one has to take into account the possibility of using a coal gas with or without the ordinary purification process, and with the purification beyond the normal which is effected by processes of benzole removal, or by such treatment as is given in the Carpenter-Evans process. This investigation is also proceeding at Leeds.

THE AUTHOR'S REPLY.

Mr. A. Mackay's valuable contribution to the discussion is, in itself, an extremely fine recommendation for national co-operation. We in Newcastle have been taking an interest in the use of gas in pottery firing for a considerable time, and having read this contribution it is obvious that many of our troubles have been experienced and overcome by Mr. Mackay. For the good of the Industry it is obvious that the information which we possess regarding the heavy industries of this district should be as freely distributed as Mr. Mackay has done with his knowledge of the pottery industry, and one hopes that the machinery which is now being put into operation for co-operation will speedily make valuable data of this nature freely available to all who are interested.

In his concluding paragraph Mr. Mackay mentions that an experimental firing tunnel is to be built in a factory rather than in the Stoke Industrial Laboratory, and this substantiates our own experience in Newcastle; in fact, there have been cases, such as the experiments mentioned regarding heavy forging, which would have been quite impossible to carry out in an industrial laboratory. We feel that the manufacturer likes to see gas doing his work in surroundings which are more natural to him, and that gas should have an opportunity of showing its ability to every-day practice.

Prof. Cobb describes the interesting efforts which are now being made by Leeds University to overcome the difficulty arising out of scale formation on steel. It is a common claim by industrial salesmen that there is " practically no scale " with the use of gas fuel. While this expression is to a very large extent true, truer, in fact, in the case of gas than any other fuel, it is not quite good enough for many of the exacting metallurgical problems which are met in almost every-day practice. The efforts therefore which are being made to overcome this difficulty are of the greatest value to the Industry; the greatness of this value is perhaps best realized by those who are in direct every-day touch with the use of various fuels for treatment of special steels.

The valuable work which has been done by the Sheffield Gas Company in this direction will go far to placing gas in a position vastly superior to that of its competitors, and one believes that with the co-operation of such institutions as Leeds University the time is not far distant when it will be possible to offer without reservations gas as a non-scaling fuel.

Mr. J. H. Clegg mentions our experiments with high-speed engines for the generation of electricity. At the time that this paper was prepared the experiments were in an undeveloped state, and the question of gas consumption per brake horse-power hour had been given comparatively little attention in comparison with the overcoming of certain mechanical difficulties which the very first tests made showed to be of considerable importance. Our object in the development of this generating set has been to keep the space occupied down to a minimum; and to do this we endeavoured to cut out the old-fashioned water tank cooling system common to most gas engines. As we had experienced difficulty in the rapid rise in lubricating oil temperature, it became necessary to find a system which would control both cooling water and lubricating oil temperature. This difficulty has been overcome by the aid of the Serk Radiator Company, who have developed a six-section unit, four sections to handle the cooling of the water and two for the oil. The unit is only 3 ft. 1 in. height, 2 ft. in width, and 11 in. deep, and has a remarkably good performance. The water circulating rate is 350 gallons per hour and the oil at 150 gallons per hour; the cooling performance for the water is from 180° F. to 160° F., while the oil is from 150° F. to 138° F. At these temperatures it is possible to run the engine for an almost indefinite period. It is of interest to note that the cost of this complete unit is only £19, and that the energy required for its operation is only 0·78 B.H.P.-hour.

The question of gas consumption is now having our close attention, and we are satisfied that this is entirely dependent on cylinder head and induction system design, both of which are closely related to compression ratio.

With regard to compressed gas for motor vehicles, I have endeavoured to put forward the position as it is at Newcastle. We are working upon an extremely efficient petrol engine, and it is going to take a considerable time to bring this engine up to petrol or better than petrol performance. Many factors enter into our experiments which are not likely to be repeated elsewhere; the engine in question, having a higher compression ratio than is usual for 'bus engines, does not allow us to obtain for gas the improved efficiency which would be effected in this direction without seriously upsetting volumetric efficiency. We are, however, at the moment engaged upon the design of a cylinder head and induction system which will enable us to obtain an even higher compression ratio without in any way interfering with volumetric efficiency. I am confident that there is a great future for the use of gas as fuel for internal combustion engines. The results which are being obtained in different parts of the country are an ample indication of what can be done, and I am not altogether sorry that the experiments at Newcastle have not been as straightforward as was originally anticipated, as I believe that the experience which we have now gained will be of the greatest value when large-scale conversions of engines of different manufacture are to be considered.

Mr. A. Allen refers to the section of my paper headed " The Iron and Steel Industry," in which the total costs for repairs to the furnace and producers are grouped in such a way that it is not possible to divide furnace maintenance from producer maintenance. Since the introduction of gas, however, the amount spent on furnace maintenance has been so small that it is obvious that considerably more must have been spent on the furnace with producer gas firing to justify the difference between the all-in gas costs and the all-in producer costs. When the furnace was changed over to town gas the silica bottom was in a very bad condition. After the first week's run it was decided that it would be to the advantage of gas if it were possible to allow the heat to circulate more freely about the slabs lying on the hearth. For this reason the silica bottom was abandoned and replaced by a furnace hearth built up of ordinary firebrick slabs, the hearth having suitably raised steps to permit the freer circulation of the hot gases.

Since the alteration to this hearth a little more than 5000 tons of material has been passed through the furnace, and as yet nothing has been spent on repairs or renewals. There is every indication that a hearth of this nature will stand up to high temperature and rough usage for a very considerable period.

Regarding the smaller amount of electrical energy required when operating on town gas, it has now been definitely established that the more thorough heating obtained with this fuel, in comparison with producer gas, results in a thorough soaking temperature, which has a direct effect on the energy required when the material is being rolled. The plates, and especially the sheets which have been rolled since the introduction of gas, show a decided improvement over the producer gas results, the quantity of scale being reduced to an absolute minimum. This is, of course, of considerable value in the rolling of thin sheets.

In reply to the question regarding the physical properties of the steel, when heated in town gas fired furnaces, I have no data on this matter, as the majority of the output of the rolling mill company is used for work which does not involve a tensile and elongation specification.

Mr. P. Lloyd mentions the all-gas bakery of the Newcastle-upon-Tyne Co-Operative Society and the consumption of 600 c.ft. per sack of flour baked which is being obtained. These results are from steam-tube draw-plate ovens, and cannot therefore be compared with the direct firing principle of the Cox Heat Trap Oven as mentioned by Mr. Lloyd. The capacity of draw-plates under consideration is approximately $\frac{7}{8}$ths of a sack per plate, or $1\frac{3}{4}$ sacks per oven. This quantity of bread is handled in 45 minutes, and until such times as an oven of the Cox type is available with draw-plate arrangements it would appear that the steam tube type must be generally accepted.

The consumption of 600 c.ft. per hour is unquestionably high, but there are the following special circumstances in this installation. It is one of the principles of the Co-Operative Societies to employ no night labour, and thus the baking time is comparatively small as compared with the non-baking time. In the bakery mentioned there are nine double-deck ovens engaged on the baking of 600 sacks per week. Were night baking employed, four to five ovens would easily handle this quantity. The amount of gas mentioned includes all heating up consumptions; and when it is realized that on Mondays, Tuesdays, and Wednesdays of each week the ovens are only baking between the hours of 4 a.m. and 10 a.m., the amount of gas required to bring the ovens up to temperature after such a long shut-down period is very considerable. Since the presentation of this paper, we have converted from fuel oil to gas a continuous oven handling bread at the rate of $7\frac{1}{2}$ 20-stone sacks per hour; in this case the all-in consumption per sack does not exceed 380 c.ft.

In Mr. Lloyd's remarks regarding gas and electric furnaces for carburizing I would direct his attention to the results which have been obtained by Dr. C. M. Walter, of the Birmingham Gas Department, at the Tyburn Works of the Moss Gear Company. The comparison of gas and electric costs in this case is rather striking, and where gas is being offered at 5·4d. per therm and electricity at 0·6d. per unit, with the possible offer of 0·5d. per unit, irrespective of either kilowatt demand charge or time factor

charge, the difference between gas and electric costs is not so much as might be at first imagined; actually, in the carburizing installation mentioned, the estimated saving by the use of gas amounted to only £2 15s. per week. The furnaces mentioned are of Gibbons manufacture, having Electroflo temperature and damper control. The extremely low maintenance costs typical of these furnaces has more than justified their installation, and it is of considerable satisfaction to us that they were the first step to what is now an all-gas heat treatment shop where eleven furnaces of different types are in more or less continuous operation.

The cooling-down curve shown in Fig. 1 should be associated with a furnace of the type illustrated in Plate 3, and is intended as an indication of the need of adequate insulation. The remarks relative to efficiency apply to this furnace, which is used for the annealing of high-duty steel castings, rather than to the installation previously described.

I am in agreement with the suggestions made by Mr. Lloyd regarding the advantages of gas, and the points which he raises are very sound and help to indicate the position which gas occupies in relation to other fuels.

Centralized Manufacture and Distribution of Gas in Belgium

By GEORGE EVETTS, M.Inst.C.E., M.Inst.Gas E.

Dr. E. W. SMITH, C.B.E., M.Inst.Gas E., F.I.C. (Woodall-Duckham Companies), writes: Mr. Evetts' Paper is of peculiar interest, dealing as it does with the production of gas at a large central point and its distribution to several points of supply. Those who have studied the economics of what is known as a " gas grid " quickly realize that it is only justified where there are large volumes of gas to be distributed to a limited number of points lying on one trunk main. Any scheme which sets out to supply a large number of isolated centres having relatively small demands for gas soon becomes burdened with a huge capital outlay.

The gas grid described by Mr. Evetts consists primarily of a 73-mile, 20-in. main, with only one side offshoot at present constructed and two side offshoots under construction. It supplies one of the most densely populated areas in the world which, in addition, is highly industrialized and where there is a large demand for hard coke. This is the first factor making for the success of a gas grid.

While there are individual areas in this country quite as densely populated, they are not of such large extent as that in Belgium. Hence, the possibility of successful application of a similar scheme in this country is obviously much more limited.

It would be interesting to know the number of domestic and industrial consumers supplied by the grid.

The second factor in the successful application of a gas grid lies in low capital cost of mains. The Belgian scheme appears to have been favoured in this respect. The Gas Areas Committee which, in 1928, very carefully examined the cost of distribution, estimated that a 20 in. steel main would cost (complete) 85s. per yard as against the figure of 40s. per yard given by Mr. Evetts. In fact, the pipes alone would cost about 40s. per yard and even to-day it is questionable if the pipes could be got for less than 35s. per yard. Would Mr. Evetts supply a dissection of this cost showing mainlaying separate from material? Mr. Evetts gives the cost of transmission and compression as 1½d. per 1000 c.ft. Would he state what is the cost at which power is debited?

It is interesting to know that the Belgian gas grid is handling 85 million c.ft. per mile per annum—*i.e.*, nearly double that in the Ruhr scheme, and in this connection it may be noted that if the scheme proposed by the Gas Areas Committee reached the size visualized in the report the gas sold would be 343 million c.ft. per mile per annum.

GAS QUALITY.

Since the cost of gas transmission per therm is affected appreciably by the calorific value of the gas, it would be useful if Mr. Evetts would say why a calorific value higher than 477 was not decided upon. The conditions under which gas is bought and sold by the grid, especially the rebates and penalties, will be studied carefully.

With regard to the specification of gas quality the permitted quantity of naphthalene—namely, 4·4 grains per 100 c.ft.—will be considered by British gas engineers to be high, especially for compressed gas. Have any troubles with naphthalene deposits been experienced, or does the gas, in fact, contain a lower quantity than the permitted maximum?

It is noted that when the price of coal is £1 per ton, the price of gas to the coke ovens is about 6d. per 1000 c.ft. In England it may be taken that coke ovens realize about 6d. per 1000 c.ft. when coal is only about 12s. per ton. In England it has not been the usual practice for bulk supplies of gas to be purchased on a basis of 60° F. and 30 in. saturated, but on meter reading, and it is interesting to note that in Belgium gas is paid for on the basis of correction to 15° C. and 760 mm.

The control of calorific value has been one of the points which has given rise to many misgivings in the minds of British gas engineers when considering taking bulk supplies of gas from coke ovens. Mr. Evetts may be willing to give answers to such questions as, " Where are the holders, and who owns them? " While the grid may decline to accept gas when its calorific value is below 425, what happens when the calorific value is between 477 and 425? Does the grid isolate this gas and mix it with richer gas, or is the customer left to do the best he can with it?

Coming now to the economics of gas production at Pont Brûlé, Mr. Evetts rightly stresses the importance of the coke factor in justification of the adoption of coke ovens at Pont Brûlé. In fact, the whole scheme depends on there being a large market for coke oven coke at a price which is relatively high to that of the coal from which it is produced.

Mr. Evetts gives figures showing the flexibility of the plant as regards production of gas and coke. If the amount of coke which is produced and which must be sold per therm of gas sold be calculated in each case, it will be found that from 0·205 to 0·443 cwt. of coke must be disposed of per therm of gas. It may be taken that in usual gas-works practice in this country about 0·1 to 0·125 cwt. of coke only has to be disposed of. The difference is partly due to the use of low volatile coals at Pont Brûlé, but more particularly it is due to the fact that one battery is heated by coke oven gas.

A further interesting point is that the amount of coke produced per therm of gas increases the lower the output of gas. Generally the demand for coke—*i.e.*, domestic coke—decreases with the demand for gas. Consequently, considerable stacking of coke in summer months must be required. In this connection Table I. will repay study, though it must be confessed that it has been found impossible to reconcile some of the figures given.

COMPARISON WITH VERTICALS.

It is shown in this Table that the cheapest gas is made in coke ovens heated by coal gas. It is noted that in order to produce 7 million c.ft. of gas per day in coke ovens heated by coal gas, nearly twice as much coal is required and nearly twice as much coke must be sold than in continuous verticals heated in the same way.

If the price of coke remains high then obviously the coke oven scheme pays the better, but 1s. per ton decrease in the price of coke wipes out the adverse balance of the continuous verticals, and a drop of 1s. 6d. per ton would definitely place the balance in favour of continuous verticals. It is interesting to study this aspect of the question in conjunction with the figures given in Mr. Hunter's Paper. Mr. Hunter showed that under the conditions he postulates, continuous and intermittent verticals produce a rather cheaper gas than coke ovens, whereas the reverse is the case in Mr. Evetts' Paper. The main factor which determines this reverse is the coke factor—both quantity produced and the ratio of coke price to coal price.

Mr. Evetts shows that the cost of producer gas with coke at 12s. per ton is 1·28d. per therm, which is practically the same as the value of the coke oven gas. It, therefore, is a doubtful economic course to substitute coke oven gas firing by producer gas firing. Further, it only just pays to dilute the coke oven gas with producer gas, with coke at 12s. per ton. One would like to know whether, in the event of heating the S.O.C. battery with producer gas, there would be sufficient coke at 12s. per ton without having to use coke of the more valuable grades. In the latter event, the cost of

producer gas may be so much increased as not to justify using it as a diluent.

In connection with the test results, the heat consumption stated as therms (net) per ton of coal at 5 per cent. moisture is the low figure of 870 B.Th.U. per pound of wet coal. It must, however, be pointed out that the coals are of low volatile content. The heat consumption, when coking high volatile coals such as are more usually used in this country, would undoubtedly be higher. This statement received substantiation from the heat consumption at Beckton where the coals have, it is believed, a volatile content of about 34 per cent.; 9·7 per cent. dry ash-free coke converted into cold producer gas firing at an efficiency of 72 per cent. is equivalent to about 1000 B.Th.U. per pound of coal.

Mr. Evetts gives some attractive costs of gas. With capital costs at 0·5d. per therm, the capital costs are equal to 2·4d. per 1000 c.ft. With gas at 6d. per 1000 c.ft. there is 3·6d. per 1000 c.ft. to cover net cost of coal and manufacturing costs. The latter apparently amount to 3·3d. per 1000 c.ft. leaving 0·3d. per 1000 c.ft. as the net cost of coal. This is extremely low and shows the great importance of the high monetary yield for coke and residuals.

The Paper is full of interest, and, though it is doubtful if similar conditions will ever be met with in Great Britain, the experiences at Pont Brûlé will repay careful study.

THE AUTHOR'S REPLY.

Mr. A. H. Lymn points out that the use of cheap coals is not necessarily associated with coke ovens. In the paper the author did not claim that these advantages were confined to coke ovens, but included it as one of the points in favour of coke ovens. The same applies to blending plants. A blending plant is a rarity in ordinary gas-works practice. It is an essential part in modern coke oven practice. Another reason for mentioning this was to stress the advantage of blending. It is the existence of the blending plant which to some extent enables the coke oven to be cosmopolitan in its choice of coals.

With regard to the steaming of coke ovens, the author has no experience of this, but is interested in Mr. Lymn's statements and would be glad to obtain further information from him at some future time.

Mr. Lymn referred to the flexibility of coke output when operating to a fixed gas output, stating that this was not necessarily a peculiarity of coke ovens. This is true, but fixed coke output is not always associated in gas-works practice with standardization of gas analysis.

It is agreed that compound heating can be applied to other forms of carbonization, thus keeping the gas analysis constant, but this has not hitherto been systematically adopted in British gas-works practice.

Mr. Lymn draws attention to the apparent difference between the figures for the heat consumed in the ovens as shown in calculating the output and those actually reached during the tests. In the section headed "Summary of Gas Manufactured and Coke for Disposal," a figure of 23 therms per ton was used for the purpose of calculating the result under normal working conditions in order to estimate the coke production by various methods of oven heating. As Mr. Lymn points out, this figure is gross, whereas the test result is net, and a further adjustment has to be made in view of the fact that both batteries of ovens would rarely be working at full capacity. Apart from this, one must remember that round figures were taken merely for the purpose of calculating the flexibility of coke production.

Reference is also made to the various figures in Table I. This Table was calculated on a standard output of gas—viz., 7 million c.ft. per day—and was made up from a series of estimates in order to get an approximate cost of gas per 1000 c.ft., and therefore results had to be used which could be guaranteed in regular working. The results of the first battery were known, and the Table was prepared in order to give information to guide the Company in regard to the construction of the second battery.

The benzole yield in the Table in each column is taken at 0·8%, and consequently if the estimate is wrong the yield would be affected in each column, but not equally. If any error was made here, however, it was on the safe side, because it has been proved that the benzole yield in the ovens is more than the estimate.

Mr. Lymn also made reference to the disadvantages under which the contractor has to work when constructing both the first and the second units, and he made reference to the employment of Belgian sub-contractors. This may have caused a certain amount of delay in finding out suitable sub-contractors for the work, and even delay in completion of sub-contracts, but there were compensating advantages. We must remember that if this job had been in England with foreign specialists as contractors, we should ask for as much English material and sub-contracting work as possible. Therefore there was nothing unreasonable in the principal Company doing this, seeing that the subsidiary was entirely Belgian.

With regard to the transport of material, the author recommended the Company to engage a railway expert for the siding layout, after drawing up a programme of requirements, and the relatively smooth working was the result.

With regard to the shape of the coal bunkers, it was considered, both in the first and second batteries, that the shape selected was a good one and would prevent the hanging up of coal. The real cause of hanging up was the use of coal with a much greater percentage of moisture than was visualized at the time the plant was built. It was also necessary to change the coal mixture. A greater proportion of English coal was used at the time the plant was first built, but the quota system came into operation in Belgium and the result gave a comparatively low percentage of English coal, so that something like 15% of English coal is used to-day, the balance being Belgian and German, some of which contains a large percentage of moisture.

Mr. Lymn drew attention to the fact that sulphate of ammonia is a profitable business in Belgium. This is true, one of the reasons being the low price of acid; and the prospects of the profitable manufacture of sulphate of ammonia naturally guided the Company in its choice of ammonia plant.

Coming to the point raised on the test result in Table III., the figure of 4·11% moisture in the coke in the confirmatory test is exactly as described. The spraying pipes were found clogged, and in that particular period the Company resorted to spot quenching. As a rule, the coke is sent out with a moisture content of about 1½%; consequently it was not market conditions which had anything to do with the high moisture content on that day. On the other hand, there was no blame attached to the contractors.

Mr. Lymn makes interesting reference to the fact that the town of Mons on the grid is receiving a higher calorific value than the remaining portions. This special supply pipe is shown on the loop in the South-Western end of the grid. The quality supplied is between 530 and 585 B.Th.U. This is on account of having a certain amount of methane obtained as a residual from the manufacture of synthetic ammonia. Mons was prepared to take this gas in view of its previous practice, and obviously a special pipe had to be laid for this supply, and incidentally two other towns take this higher quality.

Mr. C. H. Carder mentions the cost of a 14-in. high-pressure pipe and compares it with the cheap price for the grid in the paper. It is true that the pipe was cheap to start with and the soil was easily worked, consisting practically of sand the whole way. The whole of the pipe was laid in the roads. It is a common Continental form called "pavé"—*i.e.*, stone setts set in loose sand—and there was a considerable amount of work on the grass verge or pathway. Incidentally the cheap cost of pipe laid in the road was one of the reasons why the Company did not consider any method other than below ground and following the line of the road. Taking this factor into consideration and the fact that our business lay along the main roads, the question of an overhead line or cross-country run was not seriously considered. The roads were not left in order to take short cuts at any point.

The actual cost of the pipe is given in reply to a later comment.

Reference was also made by Mr. Carder to gas drying and to difficulties regarding moisture generally. There is no gas drying plant at Pont Brûlé, and there are no after-coolers following the compressors, but the compressors themselves are water-cooled. It will be noted that the pressures are not high, and there is very little trouble from condensation in the mains. Practically the whole of the condensation occurs in the first mile and a half.

The author is obliged to Mr. Carder for pointing out the misprint in Section III. (2), p. 8, dealing with the quality of the gas. This equivalent figure of 477 B.Th.U. should be 452 B.Th.U.

It is interesting to hear from Mr. R. W. Hunter that the cost of producer gas at Beckton at 1·26d. per therm comes out so near to the author's figure of 1·28d. in Section VII. (10). It is presumed that Mr. Hunter is including in his figure interest on capital and depreciation which is included by the author.

It is also interesting to note that the labour employed at Pont Brûlé squares up so well with the total number of employees at Beckton.

Mr. Hunter rightly points out that the working results of the two plants are not comparable in view of the low volatile content of the coal mixture used in Belgium for reasons already given.

There is practically no naphthalene trouble on the works at Pont Brûlé.

Mention is also made of the low sulphur compounds figure of 15·4 grains per 100 c.ft. In fact, the Company

have no difficulty in working to a figure of 15 grains with very small variations up or down. There is little doubt that the oil washing for benzole removes a certain amount of sulphur compounds, and the coal mixture usually carbonized is less rich in sulphur than many of the English coals.

With regard to the point raised on the shatter test of coke and dealing with the coke problem generally, whatever figures may result there is no difficulty in selling the coke for domestic purposes provided it is well graded and low in moisture. It must not be overlooked that the Continental demand is for coke for closed stoves, and the anthracite which is in competition is of poor quality.

The Company have paid a great deal of attention and spent considerable sums of money in grading and handling plant, and the domestic fuel has met with so much success that the screening plant in winter is overloaded, and steps have now been taken, as mentioned in the paper, to make and to store this fuel in the summer. The principal demand is for the size ¾ in. to 1½ in., and, in a rather less degree, 1½ in. to 2½ in.

With regard to the degree of fineness to which the coal is crushed, the following are the figures:

	%
Below 1 mm. (below 1/25 in.)	50
1 mm. to 2½ mm. (1/25 in. to 1/10 in)	20
2½ mm. to 3 mm. (1/10 in. to 1/8 in.)	12
3 mm. to 5 mm. (1/8 in. to 3/16 in.)	12
Above 5 mm. (above 3/16 in.)	6

A certain amount of difficulty was experienced at first in getting the coal crushing correct, because it was found that too much coarse coal caused fracture in the coke. Experiments were made by taking bars out of the crusher and ringing the changes on the different speeds, and it is considered that the present fineness is satisfactory having regard to the quality of coke and the throughput. The 16-in. oven is carbonized in about 16½ hours.

Mr. R. J. Restall raises an interesting point in regard to the grid system. On looking at the map it appears that the loop in the Mons district is unnecessary and uneconomical. The justification for this is given in the reply to Mr. Lymn—viz., the necessity of a special pipe for the supply of Mons, Cuesmes, and Wasmuel. At the same time there is a certain amount of business on the line of the direct main, and it is hardly correct to describe the district from Mons to Tertre as "merely agricultural."

With regard to the main in Brussels—viz., Koekleberg to St. Gillies Station—there was no difficulty in laying this main except those difficulties usually associated with laying a medium diameter pipe in congested territory. The pressure on this pipe line is 6 lbs. to the square inch, although it is intended to use much higher pressures ultimately, and the compressors are constructed for 37½ lbs. This pipe was tested up to 5 atmospheres—viz., 73 lbs. to the square inch—and Mr. Restall can be assured that no unforeseen difficulty of either practical or political nature arose during the laying of the pipe or when under test.

The Imperial Continental Gas Association does not supply the heart of Brussels, but only the suburbs, and therefore the trunk main does not go right through the heart of the city, although the part around Koekleberg is fairly congested.

With regard to the comparison between the gas sold in the Ruhr and that sold on the Belgian Grid, it is admitted that the Ruhr scheme is not so favourably situated in the sense that the towns and industries are not so closely packed as in Belgium. The figure was introduced simply for comparative purposes, because it is usual to find when discussing grid transmission in Europe that the Ruhr scheme unconsciously comes to mind and forms the basis of the discussion.

It is not suggested that there is anything very wonderful in this Belgian scheme in getting a sale of 85 million c.ft. per mile, because the figures referred to by Dr. Smith and quoted by the Area Supply Committee show 343 million c.ft. per mile per annum as visualized.

Mr. Restall's comment on the price of gas in relation to the price of coal is not absolutely clear. If he is commenting upon the systems of a sliding-scale for gas varying with coal, this, of course, is not an uncommon system in England. It may be, however, that the comment is directed to the high price of gas in relation to the price of coal. It must not be overlooked that this is not a case of coke ovens having surplus gas for sale, and wishful of making a revenue of something which has hitherto been regarded as a waste product, or, alternatively, at coal breeze equivalent for steam raising purposes. This plant was built to conform to a gas demand, and the grid as a whole is justified. Gas can be delivered to hitherto independent gas manufacturers at prices lower than their own cost of production; therefore, as a rationalization scheme, this is a success. At the same time, the price charged is favourable to the consumer and unfavourable to the producer when the price of coke is very low. Generally speaking, the coke market has improved during the current year, with the result that the prices to-day are reasonable.

The comments of Mr. J. H. Clegg in regard to laying the main above or below ground have previously been dealt with. In coming to a decision on this point, one has to consider where the business lies and what would be the alternative track if overground work is to be considered. The map of the pipe line clearly shows that very little distance is to be saved by taking short cuts. Secondly, as Mr. Clegg has pointed out, there is the disadvantage of variation of temperature. Thirdly, there is the risk of damage; and it must not be overlooked that in the Ruhr there are long distances with practically no demand. The cost of the finished work was so low in the case under discussion that the savings to be effected were not important enough to counterbalance the objections. It would be more difficult to negotiate for way-leaves than to obtain permission to use the roads.

Mr. Clegg raises the question of the high naphthalene content in the gas, but it does not necessarily follow that the gas is sent out to the specification figure. The actual standard was chosen in the grid specification as being one which would be suitable without special naphthalene extraction plant, and it is a figure which has been adopted widely in Germany on this account. In fact, there has been no difficulty on this pipeline; probably if the pipe were above ground there would be if the napnthalene content reached the figure named in the specification.

With regard to the capacity of the purifiers, Mr. Clegg has rightly pointed out that this is dependent on the amount of sulphur in the crude gas and ultimately upon the coal. Too little attention is paid, when designing purifiers, to this aspect. The sulphur content in Belgium would be higher than 250 grains per 100 c.ft. in the crude gas, and the purifiers are adequate because, as previously mentioned, there is no difficulty in getting to 15 grains in the purified gas aided by the benzole washer.

The area covered by these purifiers is small because they are built up and are really a series of purifiers, one on top of another, with one thick layer of oxide, and worked in parallel, and very little difficulty has been experienced.

With regard to the electrolysis, the precautions taken at Burnley are noted with interest. In Belgium, voltages were taken at various points along the main during construction, and earth plates were inserted where required, but the author has no further details regarding such precautions.

The point raised by Mr. F. H. Robinson with regard to moisture has already been partially dealt with, but in respect of syphons Mr. Robinson was very wise in not listening to the suggestion that syphons are unnecessary. Apart from this example, the author's experience in high-pressure pipelines is that, at any rate for the first two or three syphons, there is quite a lot of moisture even at low pressures, but the amount of moisture decreases after the first two or three. In the Belgian pipeline the condensation has been less than hitherto experienced. There is practically no difficulty even at the "sinkers" where the pipeline goes under water courses. There are syphons installed, however, in case moisture should collect at these points.

The author has no particulars as to the type of preservative which was used on the inside of the main, but to the best of his belief it was a normal solution used for coating. It is doubtful whether this coating lasted very long. It was found in pumping out the syphons. Rust trouble has been prevented by installing filters at each reception station, although the author is not aware that any rust has yet been found in the pipes. It is interesting to note that Mr. Robinson's transmission costs are practically equal to the Belgian pipeline at similar pressures, although the distances in Belgium are greater.

Mr. Robinson raises an interesting point in regard to the balance of storage, and this point is also raised by Dr. E. W. Smith. The conditions in the agreement with consumers may appear somewhat complicated, but in practice the flexibility of storage is adequate, and the suppliers have no difficulty in satisfying the requisite demand. It must not be overlooked that the buyers are, generally speaking, existing gas undertakings carrying the normal storage proportion of a gas-works—say, from 60% to 100% of the maximum daily requirements. Therefore the buyers have the same obligations towards the grid as would arise in giving instructions to the carbonizing foreman of a works. The storage this evening is so much; the prospects of demand for to-morrow amount to so much; this has to be gauged in any works according to the weather conditions, day of the week, local factors, and so on. In other words, the gas make for the twenty-four hours is budgetted for, and the resulting figure is given to the grid as the prospective requirements. These requirements are added together, and this total demand is passed to the Cokeries Engineer, who can thus legislate for the succeeding twenty-four hours. The problem, in fact, is

easier than the problem in one works, because a diversity factor would arise. If the consumer were without a gas-holder and subject to a rapidly fluctuating demand, then it would be necessary to fall back upon the pipeline as a gas container, and a consumer with such a load would be expected to enter into a special contract.

Dr. E. W. Smith, in his written contribution, has rightly pointed out that the economic success of a gas grid must be dependent on relatively large quantities of gas being distributed. At the same time, his general remarks need qualification. He states: "Any scheme which sets out to supply a large number of isolated centres having relatively small demands for gas soon becomes burdened with a huge capital outlay." The term "huge" is, of course, relative, and America has shown us what can be done in the way of small pipes with extremely high pressures. The author suggests that the quantity of gas must be interlocked with the difference in cost of production at the various points. Although the capital outlay may be relatively large, the grid may be an economic success if the number of small isolated units are making gas at a very high price. If a grid is designed to link up villages hitherto unsupplied with gas, then the problem is a bit more difficult, because one has to gauge what price the potential consumer is likely to give to obtain a supply. The author's experience in the agricultural districts of Kent shows that even with gas at 20d. per therm, there is a market, and at 16d. per therm quite a good market. Therefore, if this gas starts on its travels at a cost of production into the grid at 2d. per therm, then there is plenty of room for capital outlay on the pipeline. At the same time, Dr. Smith is correct in putting the density of demand as one of the principal reasons for the success of the Belgian grid and the low cost of transmission.

Dr. Smith has drawn attention to the fact that, although this somewhat extensive grid is handling 85 million c.ft. per mile, yet the scheme visualized by the Area Supply Committee reaches 343 million c.ft. per mile per annum. The length of this Yorkshire grid is 73 miles in total, and, therefore, although Dr. Smith infers that it is difficult to find a scheme so favourably situated, yet he has found one about two-thirds the length with four times the consumption of that in Belgium. Therefore the author will agree that, although the Belgian grid is favourable, it cannot be regarded as highly exceptional.

It is difficult to give the number of domestic and industrial consumers supplied by the grid. For all practical purposes the grid is supplying the gas hitherto supplied by the town gas undertakings shown on the map. There may be occasional villages and hamlets in addition, and an occasional large industrial consumer; but these are not important. There is a large potential industrial demand either on the outskirts of towns or between towns, but the supply to-day is, for all practical purposes, concerned with the linking-up of existing gas undertakings.

Dr. Smith is correct in stating that the new capital cost has a great deal to do with the successful application of the grid, and that the Belgian scheme is favourable in this respect. The price of 40s. is made up as follows:

	£	s.	d.
Pipes	1	5	0
Laying and reinstatement	0	13	6
Specials and accessories	0	1	6
Total	£2	0	0

With regard to the cost of transmission, the cost of current included in this is assessed at 0·4d. per unit—in fact, the cost is a little lower even at to-day's rate of exchange, and was about a farthing per unit at the rate of exchange ruling when the grid was first laid.

With regard to the cheapening of the cost of transmission by a high calorific value, there were several factors to be taken into consideration, such as the most suitable quality for the manufacturing stations forming the principal suppliers and the quality which the respective consumers would be used to. Certainly, as far as concerns the grid scheme, a higher calorific value than that chosen would have cheapened the cost of transmission per therm. The specification for gas quality was one which formed a compromise between the supplying and purchasing undertakings.

In connection with the naphthalene content, the author can only stress the point that no troubles have been experienced.

With regard to the price which the suppliers receive, it is agreed that in present conditions of the coke market, the price of 6d. per 1000 c.ft. with coal at £1 per ton is favourable to the purchaser and correspondingly unfavourable to the supplier.

With regard to the possible fluctuation in calorific value, it will be noted that there are two agreements—one between the grid and the suppliers and one between the grid and the purchasers. These two agreements are so interlocked as to cause no trading difficulty in the event of fluctuations in the calorific value. If the calorific value drops, the supplier is penalized and the penalty is transferred to the buyer. The effect is that a purchaser is paying for thermal units. If the quality were to drop below 405 B.Th.U., the grid can refuse to take the gas. (It should be noted that the figures of 477 and 425 B.Th.U. are based on 0° C. The conversion should have been at 60° F. to correspond with English standard temperature. Therefore 477 should be 452 B.Th.U. and 425 should be 405 B.Th.U. approximately.)

If the calorific value happens to be between these two figures, then the producers receive less and the customers buy more cheaply. In the contrary direction, it would not be wise to encourage the customer to have a higher quality frequently. Apart from the question of adjustment of appliances, there would be complaints when the gas dropped to normal again, and the customer would purchase less than he should. It will be noticed that there is a penalty if the gas is more than 4% in excess of the standard.

With regard to the question of storage, the position can be best visualized by assuming a gas grid in any part of England laid down primarily to supply existing gas undertakings. Every purchasing undertaking would carry what it conceives to be a rational storage. Some undertakings may have excess, some may be deficient, exactly as one would find by treating them as separate undertakings, but the general storage is undertaken by the purchasers.

The storage carried by the Pont Brûlé works is approximately 3 million c.ft., or 3½ hours' make based on the maximum, but actually a little over four hours' make based on the present output. This has been found to be sufficient, and it is not surprising in view of the fact that this would increase an average of, say, 18 hours' storage in the constituent undertakings to 22 hours' total storage when adding the producers' and customers' together.

It will be realized that the coke ovens do not reckon to carry any of the customers' storage. The holders are primarily for mixing purposes and to meet any emergency against breakdown in manufacturing plant.

With regard to the economics of gas production at Pont Brûlé, Dr. Smith rightly points out that the whole scheme depends on being able to sell the coke at a relatively high price. In fact, when the scheme was originally proposed, the net cost of manufacture, including materials and wages, showed a credit.

With regard to the flexibility of coke output, it is interesting to see Dr. Smith's contrast between the potentialities of coke ovens and usual gas-works practice in this country. It should be noted, however, that the lower coke figure of 0·205 cwt. is based on the minimum with both batteries compound. In fact, there is only one battery compound, and the minimum quality of heating gas for the other battery is about 300 B.Th.U. That is to say, it cannot be heated with pure producer gas.

At the same time, Dr. Smith's general diagnosis is correct. Not only the difference between the coke ovens and gas-works practice, but the flexibility in the coke oven practice are due to the alternative methods of heating and the low volatile coals chosen in particular at Pont Brûlé. Certain coal mixtures have returned 78% of coke and breeze

Dr. Smith has touched on a further important and interesting point which, nevertheless, arises in ordinary gas-works practice—*i.e.*, the fluctuations as between coke and gas demands and the necessity of stacking coke in the summer months. It has been found necessary to store domestic coke in the summer, and this has been referred to in the paper.

With regard to figures given in Table I., Dr. Smith is right in saying that it is difficult to check some of the figures without a great deal of further information. It would appear, however, that the introduction of the following figures make the Table more intelligible, showing the cost of transporting and preparing coal, transporting and screening coke, sundry expenses on residuals and purification, power, &c.:

	£
Column 2	130
,, 3	80
,, 4	85
,, 5	70

This enables the cost of gas per 1000 c.ft. to be checked, and Dr. Smith is correct when he says that 1s. per ton drop in the price of coke wipes out the adverse balance between Columns 2 and 4, and it is fair to say that the ratio of coke price to coal price is the determining factor in these calculations.

With regard to the cost of producer gas, the paper makes reference to the fact that coal gas is a little cheaper at times of normal coke prices. It is, as Dr. Smith says, doubtful economy to substitute coke oven gas firing by producer gas firing in times of normal coke prices, and this is the reason why the first battery was made for heating with coal gas. At the same time, there are other

advantages in favour of producer gas. In view of the agreements made with the grid the debenzolized gas of about 510 B.Th.U. needed breaking down, and therefore the producer gas at 1·6d. per 1000 c.ft. is equal to the coal gas, which is worth at least 6d. In addition, producer gas is cheap from the capital point of view; the plant was quickly erected and is useful in the event of coke slumps, and it is due to the producer gas that the flexibility of coke production is achieved.

In these circumstances, the point raised by Dr. Smith with reference to heating the S.O.C. battery with producer gas does not arise, and so it is not necessary to use coke of the more valuable grades.

With regard to heating required to carbonize high and low volatile coal respectively, the author has very little experience except to state that within the variations of volatile matter from the coal carbonized at Pont Brûlé there has been no appreciable variation in the heat required for carbonization.

Dr. Smith comments upon the cost of gas, and, by deduction, he produces a figure of 0·3d. per 1000 c.ft. as the net cost of coal. He is right in stating that this is due to the high monetary yield for coke and residual products. In fact, in normal times there is a substantial credit on the net coal costs.

The following concluding paragraphs deal with certain other comments which have been made in conversation with the author.

With regard to the conditions ruling in Belgium and Great Britain respectively, the paper is intended to illustrate a useful and comprehensive experiment in rationalization which can, in part at least, be applied to British conditions. There are fruitful territorial fields in Great Britain for grid systems. The practical experience resulting from the Belgian grid can certainly be useful in planning similar schemes in this country. Take, for instance, the balance of loads. At first, this appeared an operating difficulty, but in fact it has worked out with extreme simplicity. The political and financial relationships between producers, the grid company, and the consumers are not duplicated in England; but this is, to some extent, due to the conservative outlook of the British. Some of the existing gas undertakings supplied from the Belgian grid have no connection whatever with the suppliers. Gas was bought as a business proposition because the price was lower than the then manufacturing cost. It is often a matter of extreme difficulty in England to persuade a buyer to shut the gas-works down completely, and it is not easy to visualize a grid being successful when the purchaser needs to add all sorts of stand-by charges to the initial cost of the gas. Legislation is gradually moving in a direction which will favour grid schemes, although, admittedly, the legislative difficulties in England are more severe than on the Continent.

A certain amount of interest has been taken in the capital of the constituent companies. The original capital for the grid was found by the Imperial Continental Gas Association in the first place. Afterwards certain other groups interested either in the production or the local distribution of gas were invited to come in as shareholders and the basis of the scheme was broadened. After a certain dividend has been earned on the capital, the residual profit is divided as follows:

One-half to the grid shareholders.
One-quarter to the producers.
One-quarter to the consuming undertakings.

There is no reason why similar financial operations should not work satisfactorily in England. The Powers of Investment Clauses would enable producers and consumers to be shareholders. A separate equipment company could be set up for various purposes, including the transmission of gas through a grid.

The Coke Oven Plant at Beckton Gas Works

By R. W. HUNTER, M.Inst.Gas E.,

Station Engineer, Beckton Gas-Works, The Gas Light and Coke Company.

Mr. E. G. STEWART (Gas Light and Coke Company) writes: Mr. Hunter, in the Introduction of his Paper, says that it is intended to supplement my contribution upon the subject of coke ovens and gas-works, presented three years ago. I cannot, therefore, allow the occasion to pass without adding my thanks to the Author for this highly interesting Paper. My own contribution was largely an abstract discussion; this Paper is intensely practical and is based upon a very close study of coke ovens in operation. Much that I discussed could only be of interest to Engineers of undertakings of such magnitude as would justify the installation of very large units of manufacturing plant, but many of the points which have been brought forward by Mr. Hunter, although they have been derived from experience in the starting up and operation of these ovens, are of definite interest and value to all who have the care of any type of modern carbonizing plant.

The principles involved and the methods to be adopted are the same; in particular, the manner of control of the temperature and of the stresses in the tie rods to avoid any strain or distortion of the silica work in lighting up seem to be of the greatest value, as is the scheme which is described for the setting up of a schedule of damper control to suit varying throughputs.

I am glad that in so far as the Paper records the proof of the pudding whose ingredients it was my privilege to introduce to you, I have been no false prophet. Rather I imagine the improved thermal yield which has been obtained at so low a combustion flue temperature, and the associated low cost of heating, will excite interest not only in the Gas Industry, but in the coking industry. I think we should all appreciate the data which are furnished in Table VII. wherein coke ovens are compared on a cost basis with other means of carbonizing. These figures are of great value as they are all based upon results already achieved, and it should be a matter of satisfaction to many to realize that mere magnitude of plant units is not, to-day, a prime factor in obtaining cheap gas production. As will be seen, a well-designed modern vertical retort installation can still hold its own in the struggle for low costs of production.

No credit has been given in the case of the horizontal retort costs for the waste-heat steam which is usually recovered in a modern installation. In my own figures, I did include such a cost, both in the case of vertical and horizontal retorts, but not in the coke ovens, because usually, as is well known, the exit flue gas temperature in these is too low for economical waste heat steam generation.

I would like to draw attention to the remarks made by Mr. Hunter upon the experiments that have already been carried out in connection with coal blending. To-day it is essential that the production of coke should receive as close and as careful attention in regard to quality and suitability to purpose as has been given in the past to gas. The Paper does not attempt to give any idea of the extent to which the production of proper coke, without interference with the operation of the plant as a gas making unit, has been carried out at Beckton. At a later date, however, I am sure that we shall all look forward to another Paper based upon these experiments in coke production on the Beckton plant. It is certainly well equipped to furnish the information.

In the Tables of gas composition there is a more or less steady rise in the inert content of the gas from 7 per cent. at the commencement to 10 per cent. at the present time. Perhaps Mr. Hunter could tell us whether this is due to any leakage through the oven walls or whether, seeing that the calorific value has remained unchanged, it is due to the effects of reduced throughput in the summer months, or to the blending experiments which have been mentioned.

It is mentioned in the Paper (p. 23) that, by control of the carbonizing temperatures, it is possible to vary the throughput by 25 per cent. without seriously affecting the efficiency of gas and coke production. It would be interesting to know whether Mr. Hunter's experience has already enabled him to ascertain whether this figure of 25 per cent. represents the maximum variation in throughput which can be achieved with a coke oven without resorting to coal gas firing.

THE AUTHOR'S REPLY.

Mr. HUNTER replies as follows:

Before supplementing my spoken reply to the discussion on my paper, I wish to express my thanks to the President and members of the Institution for their kind reception of my contribution, and particularly those members who have taken part in the discussion.

To begin with I would point out that the whole of the tests, records, and notes quoted were made by the works staff, and any unusual elaboration to which attention has been drawn was entirely for the information of the technical staff of the Gas Light and Coke Company. The contractors, the Koppers Coke Oven Company, Ltd., were not responsible for these, their control of the plant having ceased on the satisfactory completion of the guarantee tests. As already pointed out, we have been experimenting the whole time with variations of blends of coals, temperatures of carbonization, coking times, &c., and have been endeavouring to become familiar with the plant in every respect under these varying conditions. For regular working, the control is actually very simple, as I endeavoured to indicate on p. 19 of the paper and in Table IV.

With further reference to the question raised in the discussion by Mr. Frank P. Tarratt, I would mention that records show that in the case of an abnormally high wind from the south-west quarter the oxygen in the waste gases on one side of the battery may increase by about 1%. I would confirm that no appreciable variation in the heats is noticed.

The question of excessive formation of naphthalene experienced was resultant upon comparatively high top heats in the Beckton ovens and the high yield of gaseous therms which has been obtained from the unscreened Durham gas coals in use. As indicated in the paper, means were found for overcoming this difficulty in practical working.

With regard to the recovery of benzole, I am unable to state the yield for the coke oven gas separately, but it is probably slightly better than that from the other carbonizing sections of the works. The average yield which I stated as 3·1 gallons per ton of coal was for 95% spirit as recovered by the activated carbon process. The sulphur compounds have been reduced by this process from about 26 grains to 5·8 grains. With regard to the stoppage of the water supply to the producer scrubbers, no trouble has been experienced since the installation of a more powerful and reliable pump.

Referring to the remarks of Dr. E. W. Smith, I would point out that the question of the price of coke produced by various systems of carbonizing is complicated by the nature of the markets available for the several works, which differ considerably according to their situation. In view of the developments taking place in the uses of coke in the Company's district, it was considered best to make the comparison on an equal price basis. The price of coal, though actually lower at Beckton than any other Station, was also taken at a uniform figure for the purpose of comparison.

The variation in temperatures along the battery as indicated in Table III. is, of course, partly due to the different stages of carbonizing from oven to oven. From our observations, the differences in temperature due to this cause are in fact greater than the ± 25° C. suggested by Dr. Smith. The daily average is, however, very steady. It may be that, with more regular working, these variations will be reduced.

It is true that the system of charging the producers by hand-operated skips entails a comparatively high labour cost, but as this system lends itself to the sandwiching of two or more grades of fuel, the exact weighing of every skipful, and reliability due to simplicity, it was attractive. This was particularly so in view of the desire for first-hand information in all details of the working. I am aware of recent improvements in the design of step-grate producers, but I have not seen any records of such producers, performing similar duty, operating on exactly similar fuel and showing the same efficiency as the Beckton mechanical producers. It may be of interest to give the cost of the producer gas—with small coke at 15s. per ton, breeze at 5s. per ton, and allowing for wages, scrubber water, soft water, steam or electricity for power, capital charges at 8%, and wear and tear at 2½d. per ton of coal carbonized, the cost per therm worked out at 1·26d.

The references to naphthalene troubles in the cooling system were made as a matter of interest, but, as indicated in my remarks, the modifications in the working have proved successful in combating these difficulties.

The plant provides for the removal of ammonia in rotary washers using cooled liquor with very low free ammonia content, obtained from the plant preceding outlet of the primary coolers. The viscosity of the small amount of cooling oil used in the final coolers is not affected sufficiently to cause any difficulty in mixing with the oil to carburetted water gas plant. No difficulty should arise in disposing of this oil in the case of plants using wash-oil for the recovery of benzole. At Beckton, the coal gas is treated in washers for the complete removal of naphthalene before it passes to the activated carbon plant.

The thermal yield shown in the first column, Table II., was more than sufficient to fulfil the guarantee under the contract, and the fuel consumption was also within the specified figure; consequently no attempt was made, during the period quoted, to increase the former. Other shorter periods not referred to in the Table, with similar coal on 19-hour coking, have shown yields of more than 75 therms per ton. This was with a flue temperature of 1250° C. and slightly increased fuel consumption. I note that Durham coals have been coked at faster rates in other ovens and given thermal yields comparable with those at Beckton; it would be interesting to know whether the coal referred to was similar to the unscreened Durham coals in use at Beckton, also the temperature at which it was carbonized.

With reference to the tar and breeze yields given for continuous and intermittent verticals in Table VII., the plants referred to are at different works where conditions and treatment vary as well as the markets for the products. As pointed out by Mr. Hardie, exactly comparable data are very difficult to obtain. The breeze yield is affected by the percentage of moisture present, which in the case of the coke ovens and continuous verticals is at a minimum. The figures in Table VII., supplied by the Accountant's Department, are records of actual working over similar periods in each case, and were taken as typical and not necessarily the best record.

As suggested in the paper, the figures for wear and tear in the case of coke ovens and intermittent verticals remain to be proved. So far as the Gas Light and Coke Company is concerned in the matter of fluctuations of output and seasonal reductions, the brunt is borne by the carburetted water gas plant and horizontal retorts; vertical retorts and coke ovens having the advantage of more continuous working. I agree that this is an important matter, upon which little information relating to ovens is available.

Mr. N. J. Bowater referred to the carbon in the ash from producer grates. The 10·2% is the total carbon in the ash. Screening tests have shown that 75% of the contents of the pan is "pan breeze"—*i.e.*, material under ¾ in., the remaining 25% consisting of clinker (23%) and coke (2%). The producer plant yields approximately 150,000 c.ft. of 125 B.Th.U. gas per ton of fuel gasified. This is equivalent to about 185 therms per ton.

The heating of the Beckton ovens was modified to give higher top heats than is usual in coke oven practice. This was done in order to increase the yield of gaseous therms. In these conditions, some scurfing is necessary when on full load, but it is not serious. The recording thermometers and pressure gauges on each main are intended to indicate any difference tending to induce gas to flow down one gas offtake and up the other, any such inequality of flow being checked by adjustment of the valves connecting the assembly mains to the governor. Since the better balancing of the governors, such adjustments have not been found necessary in practice. The higher therm yield brought with it some naphthalene trouble. I have already explained the intention to cool the gas to 35° C. on the primary coolers. This temperature was temporarily reduced owing to difficulties with the final coolers. The oil cooling is working smoothly. I was apparently in error in describing the intended cooling system as "normal coke oven practice."

In a written contribution Mr. E. G. Stewart draws attention to the fact that no credit was given for waste-heat steam in the case of horizontal retorts (Table VII.). This was due to my having taken the record of working of a Beckton retort house not fitted with waste-heat boilers. In my introductory remarks I stated: "If that installation were so equipped, there would be a credit of approximately 8d. per ton of coal carbonized, making the cost per ton 11s. 5d. (instead of 12s. 1·08d.), or 1·840d. per therm (instead of 1·947d.)."

The rise in the inert content of the gas, to which attention is drawn, is attributable to experimental variations of the pressure conditions in the assembly mains and changes in the blends, duration of charges, and point at which ovens are shut off the main. At present, and for some time past, on reverting to earlier conditions, the nitrogen is approximately 6·5% with total inerts slightly over 8%.

By varying the carbonizing conditions, it has been found possible to reduce throughput on the plant by as much as 40%. It is thought that this represents the maximum reduction that is practicable, as at the temperatures then worked there is evidence of an adverse effect upon the yield of gaseous therms and benzole recovery.

Electrolytic Corrosion in Gas Mains

By Dr. W. BECK,

Kaiser Wilhelm-Institut fur Physikalische Chemie und Electrochemie, Berlin-Dahlem.

Mr. A. B. DENSHAM (Gas Light and Coke Company) writes: I should like to congratulate Dr. Beck on his most interesting Paper but at the same time to criticize his method of testing coatings. In the Research Laboratories of the Gas Light and Coke Company measurements have been made of the current that leaks through a coating using a difference of potential of 4 volts. Experiments have been carried out in parallel—in one case the potential was maintained continuously, in the other case it was only applied during the time of measurement. It was found in several cases that the first lot of coatings shewed the higher resistances after a given time. This was attributed to electro endosmosis, the carrying of water by an electric current from the anode to the cathode, which leads to the drying out of the coating. The same phenomenon also explains Dr. Beck's curves shewing a rise in resistance with time of coatings containing jute; we used to obtain similar curves when using direct current. In actual practice underground the variations of leakage currents and their occasional reversals tend to prevent any such drying out. Owing to the difficulty of measuring high resistances with a Kohbrausch bridge system, we now use an A.C. Megger specially made by Evershed and Vignoles. This works at 100 volts pressure and has a low frequency of 15 cycles to eliminate disturbing effects due to the electrical capacity of the coating.

THE AUTHOR'S REPLY.

Replying to Mr. S. C. Bartholomew, as I mentioned at the meeting, the pipe or section of cable can be supplied with the auxiliary electrode before burial. The leads are brought above ground and made fast at some suitable point. By this means an alteration of the natural structure of the earth is avoided under all circumstances.

I am in entire agreement with Mr. C. A. Masterman when he says that it is important to take particular note of the resistance to rotting of the various textile fibres under working conditions. The entirely different behaviour of the rubber paraffin composition underground as compared with its behaviour in solution is a notable illustration of the importance of this fact. The question is by no means a simple one and it involves considerations of bacteriological action which deserve thorough investigation.

I entirely agree with Mr. U. R. Evans that the result of the electric measurements should, if possible, be confirmed by investigation of corrosion effects. This was in fact done in our experiments.

To Mr. F. C. Smith I would say that we have not yet collected sufficient material to be able to form a final conclusion as to the practical suitability of the various methods described. Without doubt, it is important to make the protecting covering of the pipe resistant to mechanical influences. This has been done in many cases, and as an example I would quote the Denso tube covering. From this example it would be seen that it is possible, by means of a hydrocarbon dressing of suitable composition, to obtain entirely favourable results, as regards both the electro-chemical and mechanical behaviour.

Mr. A. B. Densham, in his written contribution, suggests that the noticeable rise in the resistance of the jute-containing wrappings may be explained by the assumption that the moisture content of the film is being reduced by a process of electro-endosmosis. As our experiments have shown, similar observations can be made on wrappings of wool impregnated with asphalt and on those of the rubber-paraffin composition. Against this attempted explanation I would object that the maximum potential difference in our experiments was small (3 volts), and that the perpendicular distance between the electrodes was considerable (usually 10 cm.). According to Helmholtz's law, however, the quantity of liquid transferred by electro-endosmosis is proportional among other things to the maximum potential gradient, and inversely proportional to the distance apart of the electrodes. Nevertheless, it can well be supposed that during the long periods of these experiments an appreciable diminution in the water content of the film would have taken place. Against this, however, it must again be objected that the production of an equilibrium condition, which in the case of electro-endosmosis is characterized by the movement of a definite quantity of liquid in a given time period, is continually liable to disturbance. For instance, the possible small loss of liquid would rapidly have been replaced, since, as was described in the paper, definite quantities of fresh water were added to the electrolytic cells at definite times.

The electro-endosmosis explanation can hardly be applied to the behaviour of the unprotected pipes, which is similar to that just described. In my view, however, the idea of the formation of semi-permeable films may furnish an explanation not only of the increase in the electric resistance of the unprotected pipes, but also the behaviour of the wrapped pipes. It was also observed that the current through samples which were permanently under potential was different from that through samples to which the electric field was only applied at the moment of measurement. In this connection, a sample must be understood to be a pipe covered with a protecting coating which is already somewhat defective. This phenomenon may also be related to the formation of surface films, as will be shown in the publication of some further experiments. At the same time, special phenomena observed under alternating current conditions will be described.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

EFFICIENCY OF SMALL WATER HEATERS.

H. Schmidt, in *Das Gas- und Wasserfach*, 1933, 76, 500-505 (June 24), points out that the efficiency of gas-heated geysers varies with the conditions of use. The efficiency when the appliance is employed for a continuous period differs from the efficiency which is obtained when water is withdrawn at irregular intervals with long or short pauses, and at different rates and temperatures, and is affected also by the pilot flame being kept alight or not during the idle periods.

Graphical methods are presented whereby the efficiency may be computed under a great variety of conditions.

TESTING OF COKE OVEN CEMENTS.

F. Hartmann, in *Glückauf*, 1933, 69, 553-560 (June 24), gives an account of work carried out on behalf of the German Coke Oven Committee, in collaboration with the Research Institute of the Vereinigte Stahlwerke A.g. and other organizations, in connection with the recently published tentative specification for coke oven cements (see "JOURNAL," 1933, 202, 912, June 28).

The results of the examination of a series of twelve proprietary cements are presented. The test methods employed were mainly those called for by the provisions of the specification. In addition, however, attention is drawn to the useful information which can be obtained from the microscopic examination of thin sections of the cement and of cement-brick joints.

Tensile strength data are given for several of the cements fired to different temperatures between 1200° and 1500° C.

Two other tests may also be employed with advantage. In one of them, a joint between the largest surfaces of two silica splits is fixed into the door frame of a furnace so that one end reaches the working temperature of the furnace (1600° C.), and the other end, in contact with the outside

air, attains a temperature of about 800° C. after four hours. Temperature measurements are made at various distances along the bricks. The joint receives differing thermal treatments throughout its length. At the end of four hours, the test piece is cut through the bricks and cement, and the appearance of the zones which have been exposed to a graded series of temperatures is examined. Evidence is thus obtained as to the temperature at which the cement commences to mature, the degree of adhesion to the bricks at various temperatures, and the effect of temperature on fissuring, shrinkage, bloating, fusion, &c.

The other test consists in building up sections of flues from bricks jointed with the cements under investigation. These are then fired in a silica-brick kiln and are examined when they come out of the kiln.

The effect of slags as a function of the temperature to which a cement has been pre-fired before exposure to the slag is also discussed. In general, resistance to slag attack increases with increase in this temperature.

Attention is drawn to the mutually conflicting requirements which must be taken into account in devising a cement suitable for use in coke ovens.

Pyrometric Economies

A New Thermocouple and a New Resistance Coil

By W. Bowen, Member of the Faraday Society.

In any thermo-electric pyrometer, the accuracy and reliability of its temperature readings depend upon the constancy of the emf.-temperature law of the thermocouple employed; and obviously the ideal thermocouple is composed of elements whose characteristics remain constant for an infinite period of time under all conditions of heating. Up to about 1910 rare-metals were almost universally employed, and even in present times there is still among engineers and metallurgists a faith that no base-metal is as perfect, the main reason for using the latter being the high cost of maintenance of the former type. It is not intended here to discuss the relative merits of rare and base-metal thermocouples, but merely to state that for many years the reliability of several base-metal thermocouples has been firmly established within their respective limits of working temperatures; so much so that the great majority of installations are now of base-metal, and the real question of present importance is the life of any thermocouple when exposed to a particular set of heating conditions.

Prevailing among the base-metal thermocouples at present in use are (1) iron with constantan, (2) nichrome with constantan, and (3) nichrome with nickel or an alloy of nickel and aluminium. When carefully selected, these materials develop characteristics which can be repeated exactly, with resultant continuity of pyrometric service, by renewing a thermocouple when burnt out; and to ensure a reasonable economic life, each type is restricted, the first to about 800° C., the second to about 1000° C., and the third to about 1100° C., with occasional use at higher limits of temperature. Even when so restricted, however, the life is uncertain, varying from one day to six months. The wide experience gained by pyrometer makers is an invaluable guide for the correct choice of thermocouple and for its correct application; and with such guidance it is fair to assume an average life of from 6 to 13 weeks when using the materials specified above. Short life means exposure to abnormally severe conditions or an unsuitably high temperature, while longer life shows a happy combination of conditions.

Too great an emphasis cannot be laid on this all-important question of thermocouple life, for the successful use of a pyrometer involves freedom from troubles of frequent renewals, testing, breakdowns and such anxieties, and consequent high cost of upkeep. Indeed, the chief cause for the displacement of the rare-metal thermocouples from the pyrometer field was the high maintenance cost of the elements and of their fragile refractory sheaths; and hence any advance in the direction of reducing these costs will undoubtedly prove of the greatest interest to thousands of engineers and heat-treatment operators in every direction of industrial manufacture, who will welcome the invention of a new material which secures this result.

The new thermocouple—called the " Pyrofer "—is composed of two wires, one of which (the original invention of Messrs. British and Dominions Feralloy, Ltd.) possesses extraordinary heat-resisting properties which are even more outstanding than nichrome, which forms the second constituent and whose satisfactory performance at high temperatures is well known. After the fullest investigations and trials, the sole manufacture of this new thermocouple has been taken up by the Bowen Instrument Company, 196, Chapeltown Road, Leeds.

It is established that the breakdown of any thermocouple of existing type is almost always due to affection of the negative element, by rapid oxidation, corrosion, dissolution, or other destructive cause. Pyrofer has been exhaustively tested under the severest conditions, and something of its merits can be gauged by the fact that—when immersed without protection in a lead bath raised to 1350° or 1400° C. —the Pyrofer thermocouple showed not the slightest sign of deterioration after some hours of heating. The new thermocouple resists destruction in highly oxidizing atmospheres at high temperature, and also resists the effect of CO, SO_2, and other gases present in boiler flues, furnace chambers, and the like. In fact, since the same materials are being used for furnace structures, resistance heaters, and other high-temperature applications, their equal value in the pyrometer field is at once apparent.

The constancy of the characteristics of the Pyrofer thermocouple has been amply proved, and its values are comparable with those generated by other thermocouples. It generates about 20 millivolts at 800° C.; and with the high sensitivity instruments of the Bowen Instrument Company (between 9 and 15 ohms per millivolt for full-scale deflection) a pyrometer of range 0°-800° C. would have a circuit resistance of between 200 and 300 ohms, amply sufficient to swamp out all incidental errors due to temperature coefficients, cable resistance, and the like.

When used in muffle or oven type furnaces up to 1000° C., the supply of a Pyrofer thermocouple is accompanied by a guarantee of 12 months' life under fair wear and tear, and with further experience it is hoped to extend this guarantee to 1200° C. The consequent economy is considerable. Further, the elimination of the sheath would result in instantaneous response of the pyrometer to temperature changes.

Of almost greater importance is the application of the thermocouple to temperatures between 1000° and 1350° C. Here the value of the Pyrofer thermocouple shows up to greatest advantage, and temperatures as high as 1450° C. have been measured on occasional trials without the slightest harm to the elements, though it is not recommended as a regular practice.

Experience regarding the life of the new thermocouple when inserted in molten metals is as yet insufficient, but in view of the few trials already made—as illustrated by the lead bath insertions described above—its great value in this connection is apparent.

The excellent properties of the Pyrofer material are further utilized in its application to resistance pyrometers; and in virtue of the constancy of its resistance-temperature characteristics, resistance coils can be applied as a means of measuring temperature. This type of pyrometer may now be used with safety up to 1000° C., and the full advantage of the resistance pyrometer extended. Such pyrometers may without difficulty be calibrated to register 200° across the full scale (say, from 600° to 800° C.) instead of commencing from " 0° C." as in the case of thermoelectric pyrometers. The more open range thus secured enables temperatures to be read off with greater speed and accuracy —points of importance, especially when employing automatic temperature control apparatus.

Existing pyrometric installation can be modified to use the new Pyrofer thermocouples and resistance coils by recalibration at reasonably low cost, so that in many cases it is unnecessary to install a complete new equipment. Immediate advantage of this new invention may thus be enjoyed by all pyrometer users.

A Hundred Years' Service at Hastings

Last year the Hastings and St. Leonards Gas Company completed a century's continuous service; and many of our readers will recollect the pleasurable visit which the Institution paid to Hastings on the conclusion of the annual general meeting in June, 1932. On that occasion Mr. C. F. Botley, Engineer and General Manager to the Company, said it marked the end of the centenary celebrations, and he could not imagine anything more in accord with his own heart's wish that he should be among his friends and see them enjoy themselves.

Mr. Botley has compiled a booklet, just published, dealing with the past and present history of the Company, from which the following extracts are taken.

The Company was established on Jan. 1, 1832, and the site of the original works, at the back of the present offices, was in some respects well chosen, and must have been a fairly isolated spot in the midst of meadows and by the side of the old Priory stream or brook.

That there was a certain amount of manufacturing plant and mains in 1832 may be judged from the fact that the Company paid the then owners £12,000 for the property, and the sale of gas in the year 1832 was 2½ million c.ft. In 1854 the output had reached 20½ millions, so that for the first few years the progress was comparatively slow. Subsequently, however, and particularly after 1870, development became more rapid.

In 1854 the Company obtained its first Act of Parliament, which was for incorporating and extending the powers of the Hastings and St. Leonards Gas Company. The next Act was in 1865, which was to authorize the Company to raise a further sum of money and for other purposes. Then, in 1883, a further Act became necessary, and this was mainly for the purpose of obtaining additional capital powers. No further statutory powers were considered until 1899. This was really a milestone in the history of the Company and became necessary because, in spite of the reconstruction of the Queen's Road Works, the gas consumption was increasing very rapidly and there were difficulties on the site in dealing with purification, which was then under the Sulphur Clauses. Under the 1899 Act, the land scheduled at Glyne Gap Works for manufacturing purposes is given as 14 acres 1 rood 19 perches, but the Company own the whole of the land up to the existing or projected roads, and along the De La Warr Road boundary have already provided some residences for employees. Ample space exists elsewhere on the site for any possible developments, and for the provision of gasholders. An important provision was that all manufacture should cease at Queen's Road within ten years from the passing of the Act, and it may be mentioned that the trials of the new Works were made in October, 1904, and that they were brought into full use in 1907. (Manufacture at Queen's Road actually ceased on June 6, 1907.)

Another important provision was the conversion of the existing shares to stock, 5% and 3½%, and the power to raise additional capital to the extent of £250,000, with a proportion of loan capital. This new stock is known as the 5% additional stock, and at the present time the Company have adequate capital powers, especially when general legislation such as the Gas Undertakings Act, 1929, is taken into account.

During the war the general business was affected in a varying degree. At times there were troops quartered in the town which led to an increase in the gas consumption, and the Management had to have the assistance of troops in maintaining the supply. At other times the severe restrictions reduced the consumption of gas considerably, and it was always difficult to obtain the necessary supply of materials. The quality of the gas suffered and prejudiced the Company's business. The Company's Engineer acted as Officer for Sussex for the Explosives Section of the Ministry of Munitions, and was also the local Officer for the production of munitions, and had other activities. At the Glyne Gap Works plant was installed for the extraction of toluole, and subsequently of benzole, and in this connection the late Lord Moulton addressed the following letter:

> "Now that it has become no longer necessary for me to call upon the Gas Industry for the supply of raw materials for the manufacture of explosives, I desire to express my warmest thanks to you for your assistance in supervising the recovery of these materials at the various gas-works in the particular district which you were good enough to take under your direct control.
>
> "That help has been of incalculable value, and in spite of your other responsibilities it has been forthcoming with a readiness with which it could not possibly have been given were it not for the great issue at stake, and to the success of which you have also splendidly contributed.
>
> "The individual effort which you and your staff made at Hastings and the production for which you have been directly and indirectly responsible, will, I am sure, ever be a source of satisfaction to you as it is appreciated by myself."

It is needless to say the gas service was of the greatest possible utility to the local hospitals, canteens, &c.

In 1923 it was considered desirable that the Company's area should be extended, and that legislation should be brought up to date as far as possible, and it was also advisable to have certain powers in regard to co-partnership and pensions. Thus, advantage was taken of section 10 of the Gas Regulation Act to promote a Special Order, and the draft of this was submitted by the Engineer to the Directors in August, 1923. Under this Order the Undertaking of the Battle Gas and Coke Company was absorbed, and after many delays and vicissitudes the Hastings and St. Leonards Gas Order, 1925, was approved by both Houses of Parliament in July, 1925. At the present time a further application for a Special Order is in hand, primarily for the extension of the Company's area.

The Company were among the first to let cookers and fires out on hire (it is recorded in 1864 that Mr. Wood was authorized to "let gas stoves at a moderate rental where he thought it advantageous to the Company to do so"); to adopt incandescent lighting, with maintenance, for street lighting (1899); to install prepayment meters and installations (1894); and to install a carburetted water gas plant (1895). For special purposes of investigation the Directors in 1894 authorized an electrical installation on the Queen's Road Works, which was carried out by the Company's own men; and in 1895-97 they allowed practical experiments to be made in regard to the naphthalene difficulty, which proved entirely successful and resulted in the process known as the "Hastings Carburation Process," used in many parts of the world. As a matter of record it may be stated that this process entirely prevents naphthalene, and renders the possibilities of corrosion in the distribution system very remote. Success depends primarily on its proper method of application. The present Engineer of the Company is responsible for it, and had during its development the assistance of a mechanic, Mr. William Hooton, who is now Chief Mechanic at the Glyne Gap Works.

In a measure, the history of the Company is a history of the Gas Industry for the period, and great credit is due to the officials of early days for the skill and devotion which they gave to what was, naturally, quite a new Industry. As illustrative of this it is recorded that, in 1841, the use of fireclay retorts instead of cast-iron retorts was being contemplated. In 1852 tar was being used for heating the retorts instead of coke, and in 1862, when difficulties arose in regard to effluent from the manufacture of sulphate of ammonia, this was being disposed of by evaporation through the works chimney—a method which to-day, for rather different reasons, has in some cases to be reluctantly resorted to. When Mr. Wood was Manager he produced an artificial oxide of iron, which was apparently used successfully until the year 1887.

The first Resident Superintendent was Mr. William Barton, with Mr. John Bryan as Engineer. In 1833 Mr. Joseph Rock, who had previously been fitter on the Works, was appointed Superintendent, and in 1834 Mr. William Ginner became Clerk and Collector, Mr. William Scrivens, jun., then being referred to as "Solicitor." Mr. Rock only held the appointment of Superintendent a very short time and was put back on fitting work, being succeeded by Mr. John Norman, who remained with the Company until 1850. Mr. Ginner was entrusted with the management in September, 1834. In January, 1849, Mr. George Inkpen was engaged as foreman of the Works, with Mr. Ginner as Manager. In June, 1857, Mr. Ginner resigned and Mr. A. H. Wood became the Manager, Mr. Inkpen still being foreman. Mr. John West, who had been with the Northampton Gas Company, became foreman on Nov. 1, 1867, on which date Mr. Inkpen vacated his position. Subsequently in 1869 Mr. West went to the Maidstone Gas Company, where he introduced the now well-known stoking machinery. At some later date he became Chief Engineer to the Manchester Gas Department. He also founded the firm now known as West's Gas Improvement Company.

In 1887, Mr. Charles E. Botley was selected out of 68 applicants to succeed Mr. A. H. Wood, who was resigning his appointment as Engineer and Manager. Mr. C. E. Botley was Chief Officer during a period of great importance in the Company's history.

On the death of Mr. C. E. Botley in 1913, his son, Mr.

C. F. Botley, succeeded him as Engineer and General Manager.

In 1882 (50 years ago) electric supply was established in Hastings, under concession from the old Brush Company, and by 1887 the Corporation had given this local company patronage to the extent of installing electricity on part of the "Front Line." Gas coke used to be very generally used for raising steam in the boilers, and payment for this was not, sometimes, forthcoming as promptly as was desirable. It is the fact that at one period the Electricity Company discussed with the Gas Company the question of the latter taking over the business, but the proposal was not proceeded with. As was not unusual with electricity supply elsewhere, much financial difficulty was experienced, and this became acute when an unprofitable public lighting contract with the Corporation was undertaken. On the completion of the contract the Company would only renew it on much higher and profitable terms, which the Corporation would not accept, and as a result a supply generating station for the supply of the public lamps was established at the old waterworks, at the rear of the Gas Company's yard. This station was only used a matter of seven months, and in operation it caused owing to vibration damage to the tank of No. 3 gasholder. So serious did this trouble become that the Company had to contemplate obtaining an injunction. Fortunately this did not become necessary. The financial position of the Electricity Undertaking, coupled with the fact that the Corporation had their own Electricity Works for public lighting, led to the purchase of the Undertaking by the Corporation in 1897, at a figure which was at the time regarded as very excessive, and was certainly much higher than a valuation made by a competent electrical engineer.

As far back as 1889 the Company had a Workmen's Superannuation Fund. This was, however, wound up in 1896, the small balance in hand being distributed among the existing members. There was also a Sick Fund, but this was not actuarily sound and was abandoned in 1912, when the National Health Insurance came into force. The payments made into this Sick Fund totalled £7098, of which the Company subscribed £4690.

Although the Superannuation Fund was discontinued it has been possible to do something for the old employees who have retired. The Management had always desired to do something to meet the question of pensions, and as a basis for this Co-Partnership was suggested to the Directors, first of all by the late Mr. C. E. Botley in 1908. It was postponed then, and subsequently the disturbance of the war held it in abeyance indefinitely. However, the promotion of the Special Order in 1923 revived the matter, and in the Order certain provisions were made to give the desired statutory permission. A scheme for Co-partnership was submitted to the Directors in April, 1923, and finally approved by them in December, 1925, coming into force on Jan. 1, 1927. A voluntary Pension Scheme was introduced at the same time but was not ultimately approved until 1927, and became operative as from July 1, 1927. This latter scheme provides for pensions on an actuarial basis, and also for a gratuity pension, so that those who subscribed to the old Superannuation Fund should have their position made secure. Both schemes were prepared specially in relation to the Company's employees and the Rules approved by Counsel, and in the case of the Pension Fund by an Actuary. The Co-partnership Scheme is on a modest basis but has proved very successful, and at Dec. 31, 1931, there were 215 members, of whom 163 were contributors to the Pension Fund, payments from which do not take effect until 1937.

Statistics.—Year Ended Dec. 31, 1931.

	£ s. d.
Capital raised—	
Consolidated stock	381,240 0 0
Debenture stock	75,080 0 0
Premiums	47,864 7 2
	£504,184 7 2
Number of stockholders	815
Coal carbonized	32,614 tons
Average cost of coal	29s. per ton
Gas made	635,894,000 c.ft.
Coke made for sale	14,516 tons
Tar made	369,642 galls.
Number of consumers—	
Ordinary	12,453
Automatic	7,045
	19,498
Turnover	£155,848
Appliances on hire—	
Cooking	8,861
Heating	1,321
Area of district	70 sq. miles
Miles of main	134½
Public lamps	74
Gas consumed by public lamps	581,000 c ft.
Number of staff and employees	257
Salaries and wages	£38,771

BOOK REVIEWS

Coal Gas for Heating Retorts.*

A New Burner.

A Technical Paper just issued by the Department of Scientific and Industrial Research deals with the design of a special burner for the use of coal gas in the heating of horizontal gas retorts developed by the Fuel Research Station.

The report draws attention to the two chief drawbacks to the use of coal gas alone for heating the retorts, the first being that the luminosity of the flame precluded the optical measurement of the combustion chamber temperatures, and the second that the smoky flame may cause a deposit of carbon round the gas nostrils. To avoid these drawbacks, dilution of the coal gas is necessary.

The use of air would form the easiest solution of the problem, but it is explained that this is attended by some danger, since a slight excess of air may cause the flame to "strike back." The present burner has therefore been designed to use hot flue-gas as the diluent, drawn in from the regenerator of the retort on the well-known principle of the injector.

Practically the only published work on injectors concerns those in which the driving fluid is at high pressure; coal gas, which in the burner under consideration forms the driving fluid, is at a comparatively low pressure, and the formulæ for the normal injector did not apply. Further, owing to the high temperature of the flue gas, greater frictional losses occurred, and back pressures were unavoidable. For these reasons, it was therefore necessary that the injector burner should be as efficient as possible.

The burner is fully described and illustrated in the Report, and an appendix deals with the influence of various factors upon the performance in actual practice. The technical problem involved, it is pointed out, concerned a special case, but it is thought that the results may help in the design of induction burners for other conditions in industry.

* Fuel Research Technical Paper No. 38—Design of a Coal Gas Induction Burner for a Horizontal Retort Setting. Published at H.M. Stationery Office. Price, 6d. net.

INTERNATIONAL COMMISSION ON ILLUMINATION.*

The Conference of the International Commission on Illumination in the September of 1931, under the Presidency of Mr. C. C. Paterson, was a memorable one. At the Congress meetings, which were held in Glasgow, Edinburgh, Buxton, and Birmingham, papers on more or less practical lighting problems were presented. This left the Commission which met at Cambridge on Sept. 14, 1931, free to concentrate upon its appropriate work.

Secretariat reports only were considered, and the nature of the material submitted can be judged from the following list of subjects, the collection of information and data for which being undertaken by the Secretariat Committees indicated: Street Lighting (Germany); Daylight (Great Britain); Vocabulary (Switzerland); Applied Lighting (U.S.A.); Coloured Signal Glass and Traffic Signs (Great Britain); Definitions and Symbols (France); Photometric Test Plates (Austria); Glare (France); Cinema Lighting (Japan); Motor Car Headlights (U.S.A.); Photometric Accuracy (Holland); Light Distribution (Belgium); Aviation Lighting (U.S.A.); Heterochromatic Photometry (France); Lighting Education (Great Britain); Colorimetry (Great Britain); Factory and School Lighting (U.S.A.); Diffusing Materials (Germany).

The various reports, together with a report of the proceedings, have now been published, under the direction of the National Physical Laboratory, by the Cambridge University Press. The price of the volume, which is excellently printed and bound, is 20s. net.

* "Commission International de Photométrie. Recueil des Travaux et Compte Rendu des Séances. Huitième Session, Cambridge, September, 1931." Published under the direction of the National Physical Laboratory, Teddington, by the Cambridge University Press. Price, 20s. net.

Design of Purifiers for the Removal of Hydrogen Sulphide from Town Gas by Iron Oxide

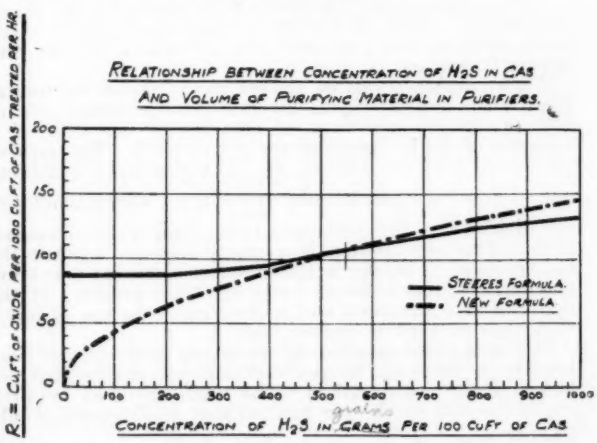
By "Proteus"

(*Concluded from p. 924, Vol. 201*)

Derivation of Formula for the Calculation of Purifier Dimensions.

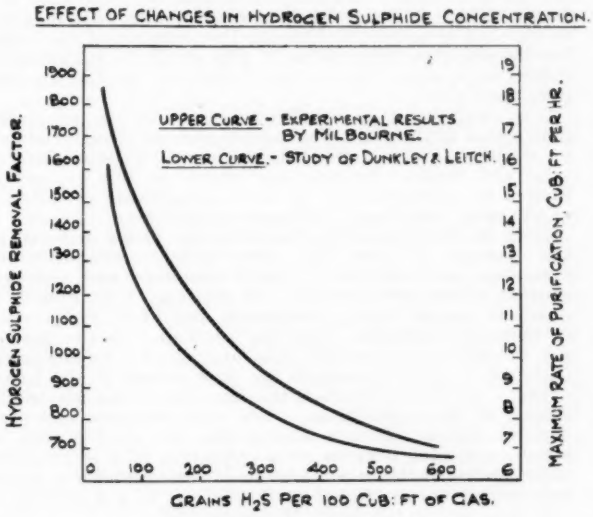
The development of a formula by which the capacity of a given plant can be calculated, or, conversely, by which the size of plant required to deal with a given quantity of gas can be determined, is of the utmost importance. It will be apparent from the foregoing considerations that not all the factors which are operative can be taken into account. Among those which it is impossible to incorporate in a formula are the temperature and humidity of the gas and the alkalinity and moisture content of the purifying material. Experience has shown that the greatest efficiency is attained when certain optimum values of these factors are maintained, and, therefore, as previously emphasized, the working conditions must always be so adjusted that these optimum values are realized. The remaining two factors—viz., concentration of hydrogen sulphide in the gas and activity of the material—however, can be taken into account, and a formula can be derived which expresses the relationship of these two factors to the ratio of the volume of material to that of the gas to be treated in unit time.

For purposes of design, current practice allows 4 to 5 c.ft. of purifying material for every 1000 c.ft. of gas treated per day[16]. Such a figure forms only a rough guide, since it makes no allowance for variations in the concentration of hydrogen sulphide in the gas and in the activity of different materials. Steere's formula attempts to take into account the effect of variations in the concentration of hydrogen sulphide. The shortcomings of this formula have been previously discussed, but they become even more apparent from an examination of the curve shown in fig. 5, where the ratio of the volume of material to that of the gas to be treated per hour is plotted against the concentration of hydrogen sulphide in the gas. The full line curve is obtained from Steere's formula, when the total depth of material is 12 ft. and 4 purifiers are employed. According to this formula, the volume of gas which a given volume of material is able to purify is dependent on the depth of material. The formula takes no account of the varying activity of different materials, and obviously fails when the concentration of hydrogen sulphide in the gas is less than 200 grains per 100 c.ft., since the ratio remains constant, when it should approach zero.



— Figure 5.—

The results of the investigations by C. G. Milbourne[7] on the sulphiding reaction (reproduced in fig. 6) suggests that the time contact necessary between gas and purifying material is proportional to the square root of the hydrogen sulphide concentration, an hypothesis supported by Milbourne's conclusion, that doubling the concentration of hydrogen sulphide necessitates an increase of 42% in the size of plant. According to the square root rule, the increase is 41%. In the absence of definite data, plant observations must be accepted, according to which the rate of revivification is one-third of the rate of sulphiding and thus is proportional to any change in the rate of sulphiding. It follows, therefore, that the time contact necessary for revivification is also a function of the square root of the concentration of hydrogen sulphide in the gas, when revivification *in situ* is practised.



— Figure 6.—

The rate of reaction is directly proportional to the activity of the material, which is a function of the content of active iron oxide in the material and its weight per unit volume. If A is the activity, F the content of active iron oxide, expressed as a percentage of the weight of the material as used, and W is the weight of unit volume of the material, KA = FW, in which K is a constant. The time-contact required for the completion of the reaction is obviously inversely proportional to the activity of the material —*i.e.*, it is proportional to $\frac{1}{A}$ or $\frac{K}{FW}$.

As the time contact between gas and material is expressed by the ratio of the volume of material to that of the gas passing in unit time, the relationship between the volume of material per unit volume of gas in unit time, activity of the material, and concentration of hydrogen sulphide in the gas may be expressed by the formula

$$R = \frac{1}{A}\sqrt{S} = \frac{K}{FW}\sqrt{S}$$

in which R = ratio of volume of material to that of gas passing in unit times
F = percentage of active iron oxide in the material as used
W = weight of unit volume of material
S = concentration of hydrogen sulphide in the gas, and
K = a constant, depending on the system of units, &c.

The value of K can be obtained from a consideration of the results of experience in large-scale operation. It is found that the best results are obtained, with revivification *in situ*, employing four boxes in a system of backward rotation, when the concentration of active iron oxide is 9 lbs. per c.ft. When treating gas containing 500 grains of hydrogen sulphide per 100 c.ft., 100 c.ft. of good quality material are required for each 1000 c.ft. of gas per hour[16]. On this basis, the value of the constant K is 4·05. Hence 4·05A = FW. The formula may therefore be written:

$$R = \frac{4{\cdot}05}{FW}\sqrt{S},$$

when the units are the c.ft., lb., and hour. If R is expressed in cubic feet of material per 1000 c.ft. of gas treated per hour, the value of the constant is 4050 and the formula becomes

$$R = \frac{4050}{FW}\sqrt{S}.$$

The chain-dotted curve in fig. 5 has been plotted from this formula for a material containing 18% of active iron

oxide and weighing 50 lbs. per c.ft., figures characteristic of a material such as "Lux." It will be observed that this curve almost coincides with that given by Steere's formula, when the concentration of hydrogen sulphide lies between 500 and 600 grains per 100 c.ft. of gas. At concentrations below 500 grains per 100 c.ft. of gas, the curves diverge, but that given by the new formula follows a more rational course than that of Steere's formula.

DETERMINATION OF THE DIMENSIONS OF A PURIFYING PLANT.

Up to the present, it has not been found possible to operate a continuous process, largely on account of the difficulty of obtaining a purifying material in a sufficiently fine state of division, while containing the water necessary to render the material active. The possible loss of fine material as dust is also a serious drawback, and its obviation presents great technical difficulties. Consequently, the static method is still almost universally adopted for dry purification. Likewise, in all modern plants, revivification *in situ* and a system of changing the sequence of the boxes has become standard practice. The volume of material required in a given case is then expressed by the formula developed above.

This single figure is insufficient to define completely the dimensions of the plant, for a given volume of material can be disposed in an unlimited number of combinations of area and depth. In practice, choice in this respect is limited by considerations of the back pressure permissible in the plant and the ground space available.

Back pressure is due to the resistance of the material to the passage of gas. It varies widely with different materials and with the physical condition and moisture content of any one material. It has long been known in practice, though rarely mentioned and never emphasized in technical literature, that the resistance to the flow of gas through purifying material, as indicated by the back-pressure, is proportional to the first power of the linear velocity of the gas through the free space, and not to the square of the velocity, as is the case generally with flow through pipes. This is due to the fact that a mass of porous material behaves as a collection of fine capillary tubes, in which the flow is viscous. The resistance is therefore directly proportional to the volume of gas passing in unit time and to the depth of the material.

The same conception also serves to explain why different materials exhibit such wide variations in resistance to gas flow. In viscous flow through a tube, the resistance varies inversely as the fourth power of the diameter of the tube. The size of the interstices in a mass of material is therefore of primary importance, and two materials of equal porosity will show a considerable difference in their resistance to the passage of gas if the particle size is different in the two cases. Although the total free space is the same in each material, the individual interstices are smaller in the finer grained substances, and the resistance is correspondingly greater. For example, if the particles of one material are one-half as large as those of the other, the loss of pressure incurred by the passage of the same quantity of gas per hour through the same depth of material will be approximately four times as great.

The effect of the moisture content of a material on its resistance to the flow of gas is similarly explained. In the dry material, the particles and interstices are small and the resistance to the passage of gas consequently high. The absorption of water causes a swelling of the particles and an increase in the size of the interstices, so that the resistance to gas flow is diminished. If the water added is excessive, the free space in the material is again restricted, so that the existence of an optimum moisture content is seen to follow as a matter of course.

For purposes of design, it has generally been assumed that a nominal linear velocity of 1 to 2 ft. per minute should be aimed at[16]. This nominal figure is purely fictitious, and is arrived at by assuming that the whole cross-section of the material, through which the gas is flowing, is free space. In a similar manner, a nominal figure for the time contact is often calculated. If a volume of R c.ft. of material is required per 1000 c.ft. of gas per hour, the nominal time-contact is $\frac{R}{1000}$ hours—*i.e.*, 0·06 R min. In order to obtain a linear velocity between 1 and 2 ft. per min., the depth of material should be between 0·06 R and 2 0·06 R = 1·12 R ft. Hence, the area of purifier that should be allowed for each 1000 c.ft. of gas per hour varies from $\frac{R}{0{\cdot}06R}$ = 16·67 sq. ft. for a velocity of 1 ft. per min. to $\frac{R}{0{\cdot}12R}$ = 8·33 sq. ft. for a velocity of 2 ft. per min.

It should be noted that, as previously mentioned, the figures calculated for the linear velocity of the gas through the material and the time-contact between gas and material are imaginary magnitudes. Since, in general, the free space in purifying materials varies from 50 to 65% of the total volume, the true linear velocities corresponding to 1 and 2 ft. per min. are 1½ and 4 ft. per min. respectively. The true time contact is then 0·030 R and 0·039 R min. in the two cases.

In plant practice a fairly wide choice for the cross-sectional area of purifiers is found, the value decided upon in a particular case being dependent upon the characteristics of the material. Bog ores are generally of open texture, and no difficulty is experienced in realizing a nominal linear velocity of 2 ft. per min. The cross-sectional area should then be 8·33 sq. ft. for each 1000 c.ft. of gas treated per hour, the total depth of oxide being 0·12 R ft.—*i.e.*, 0·03 R ft. in each box. Manufactured materials as a rule offer a greater resistance to the passage of gas, and it is generally desirable to allow a larger area corresponding to the lower linear velocity of 1 ft. per min. This can be effected by using boxes of the same dimensions, but dividing the flow of the gas in each box. The efficiency of removal of hydrogen sulphide is thereby in no way affected, since the time contact remains the same, but the area of cross-section of the material is doubled. This principle of dividing a box into a number of layers, with separate admission of the gas to each layer, is a comparatively recent innovation in purifier design, and is especially useful where the available ground space is limited. Theoretically, there is no limit to the number of sub-divisions in a purifier. By employing N layers, the area of cross-section of each box need only be $\frac{16{\cdot}67}{N}$ sq. ft. per 1000 c.ft. of gas treated per hour to obtain a linear velocity of 1 ft. per min. The latest development of the principle is exemplified in the tower purifier, where as many as fourteen layers have been employed.

Calculation of the Size of Purifying Plant Capable of Dealing with 100,000 c.ft. of Gas per Hour.

The use of the formulæ referred to above is best illustrated by an example.

Basic Data for Design of Plant.

Capacity: 100,000 c.ft. of gas per hour.

Concentration of Hydrogen Sulphide.

500 grains of hydrogen sulphide per 100 c.ft.

Characteristics of Purifying Material.

Active iron content: 18% Fe_2O_3.
Bulk density: 50 lbs. per c.ft.

The volume of purifying material required per 1000 c.ft. of gas treated per hour is obtained from the formula:

$$R = \frac{4050}{FW}\sqrt{S}.$$

In the example given, S = 500, F = 18, and W = 50.

Hence $R = \frac{4050}{18{\cdot}50}\,500 = 101$ c.ft.

A plant dealing with 100,000 c.ft. of gas per hour, therefore, should contain 10,100 c.ft. of purifying material of the above characteristics or 2525 c.ft. per box, if the set consists of four boxes.

When considerations of ground space impose no limitations, each box should be given a cross-sectional area of 8·33 sq. ft. per 1000 c.ft. of gas treated per hour, if a material of fairly open texture is employed. The area of each box will be 833 sq. ft. The depth of purifying material in each box is then $\frac{2525}{833}$ = 3 ft., which should be sub-divided into three layers of 12 in., supported on wooden grids. This sub-division is a safety measure against the development of cracks in the material and consequent by-passing. It also helps to keep the back pressure of the material at a minimum and re-distributes the gas at intervals, thus preventing uneven fouling.

The area recommended for purifying materials of close texture is 16·67 sq. ft. per 1000 c.ft. of gas treated per hour. If such material is to be used, the area required would be 1667 sq. ft. per box, so that the material would have a depth of $\frac{2525}{1667}$ = 18 in. A shallow purifier of this depth is impracticable and costly, 24 in. being probably the lowest limit of depth. Purifiers with divided gas stream and correspondingly smaller cross-sectional area would be employed. This type is particularly useful in the absence of adequate ground space, and the area of a tower becomes $\frac{1667}{14}$ = 119 sq. ft. The gas would pass through a layer of oxide of 18 in. depth. A design of this kind meets all requirements and has certain technical advantages apart from needing only just over 14% of the ground space of the first design. It is, however, outside the compass of this article to discuss the technical and economic aspects of plant design.

Corporation Undertakings' Results

Birmingham.

The Birmingham Gas Committee in their annual report to the City Council state that the quantity of gas sold last year was 13,936,568,700 c.ft., an increase of 235,104,000 c.ft., equivalent to 1·72%. This compares with 3·47% in the previous twelve months. The increase recorded is primarily on the manufacturing load, and the Committee are hopeful that this is indicative of better trade conditions for the city in the near future. The total charges against revenue account amount to £1,864,750, a decrease of £34,571. Notwithstanding a heavier expenditure on maintenance and repairs to works and plant, the total manufacturing items are reduced by £16,731, and the distribution charges have been reduced from £313,900 to £299,901. This latter reduction is principally accounted for by an item which relates to the amount expended on general repairs to mains and services. The management charges, which amount to £30,139, show a reduction of £592. The net amount received from the sale of gas shows an increase of £21,171 due to the increased quantity of gas which has been sold during the period under review. Residual products have produced a sum of £442,836, which is an increase of £19,988 over the figure reported last year. The total credits on revenue account amount to £2,300,772, an increase of £43,592, and provide a gross profit of £436,022 to be transferred to net revenue account. The comparable figure for last year was £357,859. After debiting bank interest and income-tax and making provision for annuities and interest on capital, together with redemption of capital debt, the sum of £130,434 remains to be transferred to appropriation account. From this sum the agreed contribution to the rates of £35,000 has been provided and £95,434 transferred to renewals and special expenditure account. The amount of the reserve fund now stands at £112,200, the interest received from investments—£2908—together with appreciation of investments—£18,247—having been added to the amount of £91,045 brought forward from the previous year.

Leeds.

The gross revenue for the year amounts to £656,853, and the expenditure to £479,597, leaving a gross profit of £177,256, out of which the Committee had to meet the following requirements: Income-tax, loan charges and bank interest, and contributions to capital, leaving a profit on the year's working of £1963. The quantity of gas made was 3,044,975,000 c.ft., as compared with 3,069,313,000 c.ft.—a decrease of 24,338,000 c.ft., or 0·7%. The gas produced per ton of coal was 15,817 c.ft., which compared with 15,470 c.ft., an increase of 347 c.ft. per ton. The quantity of gas sold was 2,851,653,000 c.ft., as compared with 2,900,926,000 c.ft. last year—a decrease of 49,273,000 c.ft., or 1·6%. The income from tar was £23,452, against £17,583 the previous year, the average price being 42s. 10d., as compared with 31s. 4d. per ton. Towards the end of last year there was a marked improvement in price due to the increased value of pitch and other products, and this has been maintained during the present year. The quantity produced was 11,151 tons, as compared with 11,293 tons, which is a very satisfactory result in view of the decreased quantity of coal used. The number of ordinary meters in use on March 31 was 57,301, as compared with 57,707 for the preceding year, a decrease of 406. The number of prepayment meters in use on the same date was 83,858, as compared with 81,173—an increase of 2685—making a net increase of 2279. The total number of meters in use was 141,159. The application of gas for commercial purposes has been considerably extended and 346 additional appliances fitted during the year. Central heating of buildings by gas-fired boilers has also been extended and a further 31 installations completed.

Leicester.

During the year 12 miles of new mains were laid. The unaccounted-for gas was still further reduced and is now just over one-fifth of what it was in 1909, although the length of main pipes laid is nearly double what it was then. The total gas sold was 2,539,636,059 c.ft.—a decrease of 3·64% compared with last year. It is satisfactory, however, to note that the consumers of gas continue to increase in numbers. The total number of consumers at March 31 was 82,893, and there were 1448 new consumers connected up during the year. The Department increased the number of separate apparatus supplied by 13,648 during 1932-33, and it is notable that no less than 6411 new gas lighting points were installed. The expenditure was £417,134, compared with £432,053 last year. The receipts were £544,786, compared with £563,271. The balance from revenue account was £127,652, compared with £131,218. Net revenue charges amounted to £120,343, and after crediting the account with sundry interest amounting to £1974, there is a net profit of £9282. The analysis of accounts brings out some figures of interest. The outstanding capital is 5s. 11·5d. per 1000 c.ft. sold, which is a record for the Undertaking since the purchase in 1878. The gas made and sold per ton of coal are also records, being respectively 17,902 and 17,771 c.ft.

Lincoln.

The year's working shows a gross profit of £17,670, compared with £14,879 in the previous year. Debt and interest charges amounted to £12,019, compared with £11,347, leaving a net profit of £5651, compared with £3523. The total quantity of gas sold shows an increase of 3¾ million c.ft., which is due to increased public lighting. The fall in the income is entirely due to the reduced income from residuals, which realized £2277 less than in the previous year. The gas production for the year totalled 559,935,000 c.ft., an increase over the previous year of 23,407,000 c.ft. During the year a record was created in the history of the concern, over 2 million c.ft. per day being sent out on 22 days. The Distribution Department has had a most satisfactory year, 259 new customers being added, making a total of 17,976. The value of appliances and fittings sold for the year was £7880, an increase over the previous year of £1600.

Neath.

The total quantity of gas made during the year was 243,082,000 c.ft., as compared with 235,682,000 c.ft. in the previous year, being an increase of 7,400,000 c.ft. During the year the total amount of coal carbonized was 12,977 tons, as compared with 12,782 tons in the previous year. The combined make of gas per ton was 18,732 c.ft., or 79·6 therms, as compared with 18,437 c.ft., or 78·35 therms. The amount of gas sold and accounted for during the year was 218,440,000 c.ft., as compared with 211,580,000 c.ft., showing an increase in actual sales and accounted-for gas of 6,860,000 c.ft. The final results on the year's working show that a gross profit of £11,259 has been made, as compared with £11,045 in the previous year, being an increase of £214. The profit and loss account at April 1, 1932, showed a credit balance of £6146, and after providing for repayment of loans, interest on capital, income-tax, &c., and capital plants paid for out of revenue the credit balance at April 1 this year stands at £6309, being an increase of £163.

Southport.

The gas consumed within the area of supply amounted to 808,078,000 c.ft., and when compared with last year's figures showed an increase of 4,813,000 c.ft., after allowing for the extra leakage caused by sewerage operations on the main drainage scheme. Of this amount 66·54% was registered by ordinary meters and 25·41% by prepayment meters, and the remaining 8·05% by public lamps, &c. The average price received for all gas supplied was 7·87d. per therm, which is equivalent to 36·58d. per 1000 c.ft. This is 0·04d. per 1000 c.ft. higher than last year's figure. The total capital outlay was £687,425, and the net capital indebtedness at March 31 was £283,696. The gross profit for the year amounted to £61,237, and after paying interest and sinking fund, income-tax, &c., amounting to £50,560, there remains a net profit of £10,677. Adding to this the balance of £15,054 brought forward from the previous year, the total amount at the credit of the appropriation account is £25,731. Of this amount it is proposed to transfer in aid of rates £4300; revenue contribution to capital, new meters, £2645; new showroom, £3353; re-setting of vertical retorts, £1720; leaving a balance of £13,713 to be carried forward to next year's account. During the year 611 new service pipes were laid, and 1156 new meters fixed; the total number of meters in use at the end of the year being 27,476, an increase on the previous year of 1095.

Stalybridge.

After allowing for interest on loans and sinking fund contribution there was a profit of £1521, which has been placed to appropriation account; the total income for the year amounted to £33,545. The output of gas was 140 million c.ft., and shows an increase of 0·5% on the previous year's figure. The average price of gas throughout the area of supply was 8·4d. per therm; 16% of the total revenue was accounted for by the production and sale of bye-products. This rather low figure is accounted for by the fact that the gas manufacturing plant is very old and cannot be run efficiently.

Stoke-on-Trent.

The total quantity of gas manufactured was 1,782,089,000 c.ft., or 8,375,818·3 therms, as compared with 1,729,032,000 c.ft., or 8,126,450·4 therms the previous year—an increase of 53,057,000 c.ft. (249,367·9 therms), or 3·07%. The quantity of coal carbonized in the vertical retorts was 63,991 tons and 37,422 tons in horizontal retorts, a total of £101,413 tons, as compared with 97,314 tons last year. The tar produced per ton of coal carbonized also shows an increase of 0·27 gallon this year. The total expenditure for the year is £224,203, against £216,953 last year—an increase of £7249. This increase is partly represented by the increased quantity of fuel used (amounting to over 4000 tons) in manufacturing the increased output of gas, the increase on fuel amounting to £3485. The total income for the year is £306,446, as against £301,961—an increase of £4484.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

Despite the uncertainty which exists as regards the ultimate achievements of the World Conference and the wild fluctuations in the value of the dollar against sterling, the New Account opened last week with an appreciable increase in activity in almost all sections. Many of the leading industrial shares were in demand, while a number of the more speculative issues also showed improvement. Gilt-edged securities weakened early in the week, but made a partial recovery towards the close. The volume of business in the Gas Market was somewhat smaller than usual, and confined for the most part to the stocks of the larger undertakings, though there was no change in the general tone of the market, which continues firm. Prices of recorded transactions were in several instances fractionally higher than a week ago, but few quotations were influenced. Gas Light units advanced a further 3d. to 26s., and at this price the yield, based on a dividend of £5 12s.%, the rate paid for the past four years, works out at £4 6s. 1d.%, which, having regard to the financial strength of this vast undertaking, is an attractive proposition for the permanent investor. South Metropolitan ordinary recovered the fractional losses of the past two weeks and gained 1 point to 117½, and Montevideo 5 points to 60, while, at the local Exchange, Sheffield consolidated was 1 point higher at 126. Apart from a number of reductions in debenture stocks for the usual half-yearly interest payments there were no other movements of note.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *July* 3.

The market for tar products continues steady. Current prices are as under:

Pitch, 80s. per ton f.o.b.

Creosote, 3d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, 2s. 4d; pure benzole, 1s. 9d.; solvent naphtha, 95/160, 1s. 7d.; and 90/140 pyridine bases, 4s. to 4s. 3d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

July 3.

The average prices of gas-works products during the week were: Gas-works tar, 32s. 6d. to 37s. 6d. Pitch—East Coast, 80s. to 82s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 80s. to 82s. 6d.* Toluole, naked, North, 1s. 9d. to 1s. 10d. Coal-tar crude naphtha, in bulk, North, 6d. to 6¼d. Solvent naphtha, naked, North, 1s. 4d. to 1s. 5d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2d. to 2¼d.; low gravity, 1¼d.; Scotland, 2d. to 2½d. Heavy oils, in bulk, North, 4d. to 4½d. Carbolic acid, 60's, 2s. 9d. to 2s. 10d. Naphthalene, £9 to £10. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *July* 1.

A better feeling predominates in this district, and quotations, in many cases, are somewhat steadier. Fresh business, however, is not too plentiful.

Crude gas-works tar.—Actual value remains at 42s. 6d. to 47s. 6d. per ton *ex* works.

Pitch.—The price for export is called 75s. to 77s. 6d. per ton f.o.b. Glasgow. In the home market 75s. per ton *ex* works in bulk is being obtained.

Refined tar to Ministry of Transport Specification continues to leave the works in large quantities, and the price is about 3½d. per gallon *ex* works in buyers' packages.

Creosote oil is not now available in such large quantities, and prices are a fraction firmer. B.E.S.A. Specification is 2⅜d. to 2¾d. per gallon; low gravity, 2⅛d. to 2½d. per gallon; and neutral oil, 2½d. to 2¾d. per gallon—all in bulk *ex* works.

Cresylic acid is not receiving a great deal of attention, and quotations remain unchanged. Pale, 97/99%, is 10d. to 11d. per gallon; dark, 97/99%, 9d. to 10d. per gallon; and pale, 99/100%, 1s. 1d. to 1s. 2d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha is difficult to secure for prompt delivery, but the value is steady at 4d. to 4½d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 3d. to 1s. 4d. per gallon, and 90/190 grade 11d. to 1s. per gallon *ex* works.

Motor benzole.—Supplies are scarce, and the value is 1s. 5d. per gallon f.o.r.

Pyridines.—90/160 is 3s. to 3s. 3d. per gallon, and 90/140 grade 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole . . .	0 9	to	0 9½	per gallon at works
Motor ,, . . .	1 4	,,	1 4½	,, ,, ,,
Pure ,, . . .	1 7½	,,	1 8	,, ,, ,,

Contracts Advertised To-Day.

Coal.

Haverhill (Suffolk) Gas Department. [p. 60.]

Workington Gas Department. [p. 60.]

New Capital Issues.

Gloucester Gas Light Company are issuing £40,000 perpetual debenture stock, which is being offered for sale by tender at a minimum price of £101%.

Trade Notes.

Newton, Chambers & Co., Ltd.

This firm has received orders for the following: Lea Bridge District Gas Company—Five purifiers, 30 ft. by 35 ft. by 6 ft., with valves and connections, oxide handling plant, and reinforced concrete revivifying floors. Boston Gas Light and Coke Company—Dismantling an existing 3-lift gasholder and the provision of a new 3-lift spiral gasholder, 350,000 c.ft. capacity. Birmingham Corporation Gas Department—Dismantling two existing gasholders at the Adderley Street Works, and the provision of two new spiral-guided gasholders, 240,000 and 127,500 c.ft. capacity.

W. J. Jenkins & Co., Ltd.

This firm has obtained a further order for the British Gas Light Company's Holywell Works for an installation of Jenkins-Klönne intermittent vertical chamber ovens, having a nominal output of 280,000 c.ft. of gas per day. The installation will be complete with coal and coke handling plant, and will embody the salient features of the Jenkins-Klönne system—namely, patent bottom gas offtakes, delayed combustion heating, water sealed doors, and the Jenkins water troughed type step-grate furnaces. This new plant will be similar in many respects to that installed by the firm at the Westgate and Birchington Gas-Works a year ago.

Gas Acts (1920 and 1929) Orders.

DECLARATIONS OF CALORIFIC VALUE.

Barnard Castle Gas Company.

As from Oct. 1 next, the Barnard Castle Gas Company will supply gas of 475 B.Th.U.

Newton-in-Makerfield Urban District Council.

The Council give notice of their intention, as from Oct. 1 next, to supply gas of 430 B.Th.U., in substitution for the 390 B.Th.U. gas now supplied.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. July 1. (Provincial Exchanges June 30)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 3	7⅞	7	Alliance & Dublin Ord. ...	120—130	...	128⅜
374,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb. ...	85—95	...	...
557,655	,,	Mar. 6	7	7	Barnet Ord. 7 p.c.	157—162	...	...
300,000	1	May 8	1/4⅛	1/9⅛	Bombay, Ltd.	25/—27/-	...	...
178,280	Stk.	Feb. 20	9½	9½	Bournemouth sliding scale	195—205	...	...
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	157—162	...	...
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	137—142	...	...
50,000	,,	June 26	3	3	Do. 3 p.c. Deb. ...	74—79*	−1	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	99—104*	−2	...
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	120—125*	−2	...
357,900	,,	Mar. 6	7½	7½	Brighton, &c. 6 p.c. Con. ...	152—157	...	...
540,000	,,	,,	6½	6½	Do. 5 p.c. Con. ...	142—147	...	...
196,500	,,	,,	6	6	Do. 6 p.c. B Pref.	134—137	...	...
1,487,500	,,	Mar. 6	5	5	Bristol 5 p.c. max. ...	110—111*a*	−1½	...
120,420	,,	June 26	4	4	Do. 1st 4 p.c. Deb. ...	99—100*a**	−1½	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	99—100*a**	−1½	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	119—122*a**	−1½	...
855,000	,,	Apl. 3	7	7	British Ord.	147—152	...	...
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.	144—149*	−3	146
350,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	103—108*	−2	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	94—99*	−1	97—98 7/16
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	103—113*	−2	...
160,000	,,	June 26	5	5	Cambridge 5 p.c. Deb. ...	115—120*	−2	...
100,000	10	May 22	6	4	Cape Town, Ltd.	7—8	...	...
100,000	10	Apl. 24	4½	4½	Do. 4½ p.c. Pref. ...	6—7	...	...
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. ...	87—92*	−1	...
626,860	,,	Feb. 20	6	6	Cardiff Con. Ord.	119—124	...	...
237,860	,,	June 26	5	5	Do. 5 p.c. Red. Deb.	105—110*	−2	...
157,150	,,	Feb. 20	5	6½	Chester 5 p.c. Ord.	105—110*b*	...	...
98,936	1	May 22	2/-	2/-	Colombo, Ltd. Ord.... ...	25/—30/-	...	...
24,500	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	18/6—20/6	...	...
609,204	1	Mar. 20	-/11'48	-/11'48	Colonial Gas Assn. Ltd. Ord.	17/6—20/-	...	...
296,053	1	,,	1/3'30	1/3'30	Do. 8 p.c. Pref.	1 3/16—1 5/16	...	...
1,796,955	Stk.	Feb. 20	5	6½	Commercial Ord.	112—117	...	112½—115
475,000	,,	June 12	3	3	Do. 3 p.c. Deb. ...	74—79	...	74
265,272	,,	Mar. 6	—	5	Do. 5 p.c. Deb. ...	120—125	...	...
807,560	,,	Feb. 20	7	7	Croydon sliding scale ...	145—150	...	...
469,590	,,	,,	5	5	Do. max. div.	101—106	...	103—104½
500,000	,,	Jan. 9	5	5	Do. 5 p.c. Deb.	120—125	...	...
542,270	,,	Mar. 6	7	10	Derby Con.	150—160*c*	...	...
56,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	80—85*c*	...	...
209,000	,,	Mar. 6	5	5	East Hull Ord. 5 p.c. ...	106—111	...	...
179,500	,,	Mar. 6	6	6	East Surrey Ord. 5 p.c. ...	120—125	...	122½
155,019	,,	June 26	5	5	Do. 5 p.c. Deb. ...	115—120*	−2	...
1,002,180	,,	Apl 3	15	17	European, Ltd.	128—133	...	128—135
19,373,992	,,	Feb. 20	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	25/6—26/6*f*	+-/3	25/10½—26/4½
2,600,000	,,	,,	3⅛	3⅛	Do. 3⅛ p.c. max.	85—88	...	85½—86†
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	99—102	...	99½—100⅝
6,102,497	,,	June 12	3	3	Do. 3 p.c. Con. Deb. ...	76—79	...	76—77½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	112—115	...	114½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	108—111	...	109½—110½
270,466	,,	Mar. 6	6	6	Harrogate New Cons. ...	115—120	+2	...
82,500	,,	Mar. 6	7	7	Hastings & St. L. 5 p.c. Conv.	138—143	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	110—115	...	...
70,000	10	Apl. 24	†10	†10	Hongkong & China, Ltd. ...	14—15	...	...
218,200	Stk.	Mar. 6	6	6	Hornsey Con. 3½ p.c. ...	122—127	...	...
5,600,000	,,	May 22	10	14	Imperial Continental Cap.	200—210	...	206—209
223,130	,,	Feb. 6	3½	3½	Do. 3½ p.c. Red. Deb.	89—94	...	...
235,242	,,	Mar. 6	8½	8½	Lea Bridge 5 p.c. Ord. ...	170—175	...	...
2,145,907	,,	Mar. 6	6	6	Liverpool 5 p.c. Ord. ...	125½—126½*b*	...	...
245,500	,,	June 26	5	5	Do. 5 p.c. Red. Pref. ...	103—113*b**	−2	...
306,083	,,	Jan. 19	4	4	Do. 4 p.c. Deb. ...	101—103*b*	...	...
165,736	,,	Feb. 20	8	10	Maidstone 5 p.c. Cap. ...	180—200	...	...
56,176	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	70—75	...	...
75,000	5	June 12	†10	†10	Malta & Mediterranean ...	9—11	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Mar. 6	5	5	M. S. Utility "C." Cons. ...	103—108	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	93—98	...	96—97½
112,126	,,	June 26	4	4	Do. 4 p.c. Deb. ...	100—102*	−2	...
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	118—118*	−2	...
675,000	,,	31 May '31	16	16	Montevideo, Ltd.	55—65	+5	53¾—54½
2,061,315	,,	Mar. 6	5	5½	Newcastle & Gateshead Con.	24/6—25/6*d*	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	99—101*d*	...	...
776,706	,,	Jan. 9	3½	3½	Do. 3½ p.c. Deb. ...	89¾—91¾*d*	−1½	...
277,285	,,	May 8	5	5	Do. 5 p.c. Deb. '43...	107—109*d*	...	...
274,000	,,	Feb. 20	5	5	Newport (Mon.) 5 p.c. max.	101—103*a*	...	...
204,940	,,	Mar. 20	7½	7½	North Middlesex 6 p.c. Con.	137—143	...	...
396,160	,,	Feb. 6	5	5	Northampton 5 p.c. max. ...	103—108	...	...
300,000	,,	Apl. 24	9	7	Oriental, Ltd.	114—119	...	...
316,617	,,	June 26	8	8	Plym'th & Stonehouse 5 p.c.	158—163*	...	160—160½
504,416	,,	Feb. 20	8	8	Portsm'th Con. Stk. 4 p.c. Std.	161—166	...	166
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	104—109	...	...
114,000	,,	Feb. 20	5	5	Preston 5 p.c. Pref.	103—108	...	...
686,312	,,	Jan. 23	4	4	Primitiva 4 p.c. Rd. Db. 1911	80—85	...	...
389,813	,,	June 26	4	4	Do. 4 p.c. Cons. Deb.	78—83*	−2	...
150,000	10	Mar. 20	6	6	San Paulo 6 p.c. Pref. ...	6⅞—7⅛	...	...
1,736,968	Stk.	Sept. 5	6	6	Sheffield Cons.	124—128*e*	+1	...
95,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	91—95*e*	...	...
133,201	,,	Feb. 20	8½	5	Shrewsbury 5 p.c. Ord. ...	125—130	...	...
90,000	10	June 12	15	14	South African	3—5	...	...
6,709,895	Stk.	Feb. 20	5	7	South Met. Ord.	124—127	+1	124—126½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	135—140	...	135—139
850,000	,,	,,	—	20/-*g*	Do. 4 p.c. Irred. Pf.	99—103	...	99½—100
1,895,445	,,	Jan. 9	3	3	Do. 3 p.c. Deb. ...	76—79	−1	78½
1 000,000	,,	Jan. 23	5	5	Do. 5 p.c. Red. Deb.	112—116	...	...
209,820	,,	Mar. 6	8½	8½	South Shields Con.	147¼—152½*d*	...	...
1,543,795	,,	Feb. 20	6	6	South Suburban Ord. 5 p.c.	124—129	...	...
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	113—118	...	113
868,837	,,	June 26	5	5	Do. 5 p.c. Deb.	118—123*	−2	...
647,740	,,	Feb. 20	5	5	Southampt'n Ord. 5 p.c. max.	107—112	...	...
121,275	,,	June 26	4	4	Do. 4 p.c. Deb.	99—104*	−1	99—100½
350,000	,,	Mar. 6	9/-	5½	Swansea 5½ p.c. Red. Pref.	108—112	...	...
200,000	,,	June 26	6½	6½	Do. 6½ p.c. Red. Deb.	103—108*	−2	...
1,076,490	,,	Mar. 6	6½	6½	Tottenham and District Ord.	142—147	...	144
300,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	123—128	...	...
62,285	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
199,005	,,	June 12	4	4	Do. 4 p.c. Deb. ...	96—101	...	...
85,701	,,	Apl. 3	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	80—85	...	...
347,769	,,	Mar. 6	7	7	Uxbridge, &c., 5 p.ct. ...	140—145	...	141—143½
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	—
1,322,220	,,	Mar. 6	7	7	Wandsworth Consolidated	145—150	...	148
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	112—117	...	113½—115
1,317,964	,,	June 26	5	5	Do. 5 p.c. Deb. ...	118—123*	−2	...
158,400	,,	Mar. 6	5	6A	Winchester W. & G. 5p.c. Con.	109—114	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—For quarter. *h.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

STOCKS AND SHARES FOR SALE.

GLOUCESTER GAS LIGHT COMPANY

are issuing

£40,000

PERPETUAL 4% DEBENTURE STOCK,

which is being offered for SALE BY TENDER at a minimum price of £101 per cent.

Particulars of the issue and Forms of Application may be obtained from The SECRETARY of the COMPANY, GAS OFFICES, EASTGATE STREET, GLOUCESTER.

Applications must be received on or before 12 o'clock noon on Monday, the 10th July, 1933.

SALE OF STOCKS AND SHARES IN GAS AND ELECTRICITY COMPANIES.

HORTON LEDGER, F.A.I., has received Instructions to SELL BY AUCTION, at the Colonnade Auction Mart, 157, North Street, Brighton, on Wednesday, July 12th, 1933, at Three o'clock, STOCKS and SHARES in the following well-known GAS COMPANIES:

LITTLEHAMPTON GAS.
BOGNOR GAS AND ELECTRICITY.
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Particulars and Conditions of Sale can be obtained of the AUCTIONEER, at the COLONNADE AUCTION MART, 157, NORTH STREET, BRIGHTON. 'Phone: Brighton 3383.

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150
ENGINEERS
Purify
66,000,000,000
cub. ft. of coal gas
per annum
with
OUR
OXIDE

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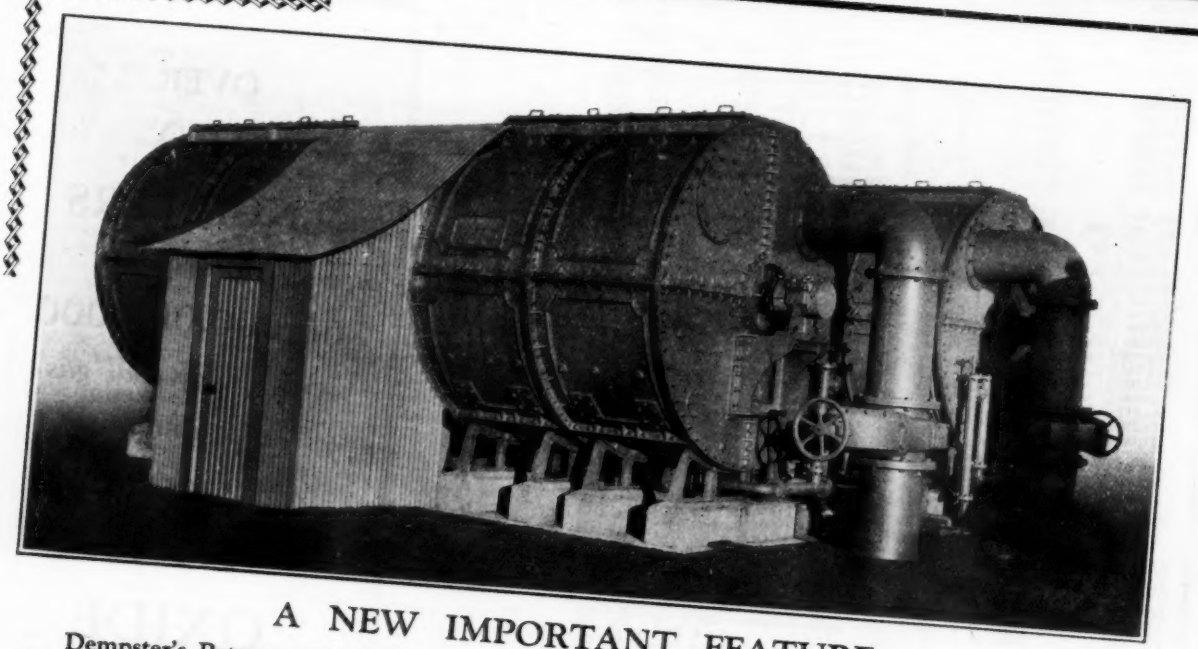

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For the circulation of wash oil in the extraction of Benzole this improved machine ensures maximum efficiency and is equally effective for the recovery of Ammonia or elimination of Naphthalene.

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NOON ON TUESDAY is the latest hour for receipt of advertisement copy for the following day's issue.

FIRST POST ON MONDAY is the latest for receipt of alterations of standing advertisements.

RATES FOR UNDISPLAYED ADVERTS: Situations Wanted, Six Lines and under (about 36 words), 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum 4s. 6d. An additional charge of 6d. is made where replies are addressed c/o the "JOURNAL."

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A copy of the "G.J." Calendar and Directory is presented to Continuous Subscribers.

UNITED STATES.—Renewals after December, 1931, and all new subscriptions in the United States, to be made through ROBERT O. LUQUEER, Agent, WOOLWORTH BUILDING, NEW YORK, N.Y.

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OXIDE OF IRON.

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Phone: Royal 1484.

"TORTO" FIRE CEMENT.

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Tins for Sale to Consumers.
In Bulk for Works Use.
(*See also the "Gas Salesman."*)

BALE & CHURCH, LTD.,
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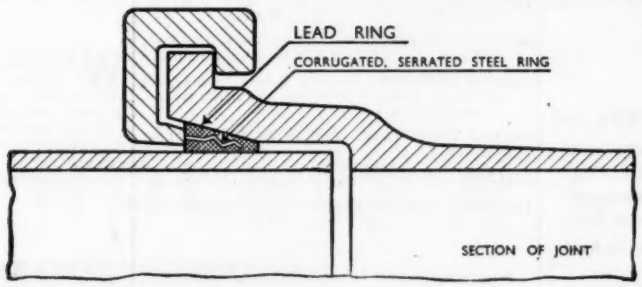
Phone: Royal 1484.

The STANTON Mechanical Lead Joint

(Patent applied for)



NO INCREASED COST

This mechanically made joint works on a similar principle to the Stanton-Wilson Joint, but employs a lead ring in which is encased a thin corrugated, serrated steel ring. It is more flexible than a caulked joint and provides for expansion and contraction of mains—No skilled labour needed.

N.B.—Where a considerable degree of flexibility is required, use the Stanton-Wilson self-adjusting Joint, which has been adopted by over 200 Public Undertakings in this country.

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ROBERT DEMPSTER & SONS, Ltd., ELLAND, Builders of CARBONIZING PLANTS, both Horizontal and Vertical. Manufacturers of CONDENSERS, PURIFIERS, GASHOLDERS, &c., also every description of COAL and COKE HANDLING PLANT. Telegrams: "DEMPSTER, ELLAND." Telephone: ELLAND 261 (Private Branch Exchange).

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Vulcan Ironworks, Church Fenton, Yorks.,
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and CONTRACTORS for
HANDLING PLANT,
SCREENS, TIPPLERS, ETC.

THE BRITISH GAS PURIFYING MATERIALS CO., LTD.,
99, LONDON ROAD, LEICESTER.
Telegrams: "BRIPURIMAT, LEICESTER." Telephone: LEICESTER 59086.
NATURAL BRITISH PURIFYING MATERIAL
AN ABSOLUTELY STANDARD PRODUCT.
MOISTURE GUARANTEED 28% SUMMER AND WINTER.
"FIRST QUALITY" DUTCH BOG ORE
As supplied to most of the Principal Gas Works in Great Britain.
SPENT OXIDE PURCHASED.

HUTCHINSON BROTHERS, Ltd.,
FALCON WORKS, BARNSLEY.
MANUFACTURERS OF
GAS METERS (Ordinary and Slot).
"FALCON" INVERTED LAMPS,
SQUARE STREET LANTERNS
SUPERHEATER BURNERS, and
CONVERSION SETS for Street Lanterns.

GEORGE WILSON GAS METERS, Ltd.
for
GAS-METERS, ORDINARIES, SLOTS, AND REPAIRS
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'Phone: 2655 Coventry. Grams: "GASMETER."
Certus Works, Kingston Road, Raynes Park, LONDON, S.W. 20.
Radium Works, 11, Radium Street, Oldham Road, MANCHESTER.
(See advertisement June 28, p. 897.)

PUBLICATIONS.

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SUPPLIED either by Price per Therm or Thousand, for any specified Calorific Value, in book form, office charts, or pocket charts for Meter Inspectors, printed in clear type. Write for particulars to F. H. WAKELIN, LTD., Calculator Specialists, 354, WHEELER STREET, BIRMINGHAM.
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THE Proprietor of Patent No. 294958, "Method of Reducing Inflammability of Hydrogen," is desirous of entering into arrangements, by way of Licence or otherwise on reasonable terms, for the purpose of Exploiting the same and ensuring its full development and practical working in this country.
All communications should be addressed in the first instance to J. E. EVANS-JACKSON & CO., Registered Patent Agents, BATH HOUSE, 57-60, HOLBORN VIADUCT, LONDON, E.C. 1, and 34, DAME STREET, DUBLIN, IRELAND.

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Town Hall,
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June 26, 1933.

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(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Workington Town Council are prepared to receive TENDERS for the Supply of 9000 Tons of GAS COAL, for delivery over the Twelve Months ending the 31st August, 1934.

Particulars and Forms of Tender may be obtained from the Engineer and Manager, Mr. Hedley Hoy, Gas-Works, Workington.

The Council do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to accept the whole or any part of the Tender.

Tenders, sealed and endorsed "Tender for Gas Coal," to be addressed to the undersigned, and delivered at the Town Hall, Workington, not later than 10 a.m. on Tuesday, 18th July, 1933.

THOMAS JACKSON,
Town Clerk.

Town Hall,
Workington,
June 30, 1933.

HAVERHILL (SUFFOLK) URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS are invited for the Supply of 1500 Tons of SCREENED GAS COAL or NUTS, delivered to Haverhill (North) Station, L.N.E. Railway, during the Twelve Months ending 31st July, 1934, in such quantities as may be required.

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No Special Forms of Tender are supplied.

The Council reserve to themselves the right to divide the Tenders or to decline any Tender.

Dated this 28th day of June, 1933.

JAMES BEASLEY,
Clerk to the Council.

Haverhill,
Suffolk.

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By order of the Board,
F. J. BRADFIELD,
General Manager and Secretary.

Offices,
Stepney, E. 1,
June 27, 1933.

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Secretary.

Head Office,
Lower Sydenham, S.E. 26,
July 1, 1933.

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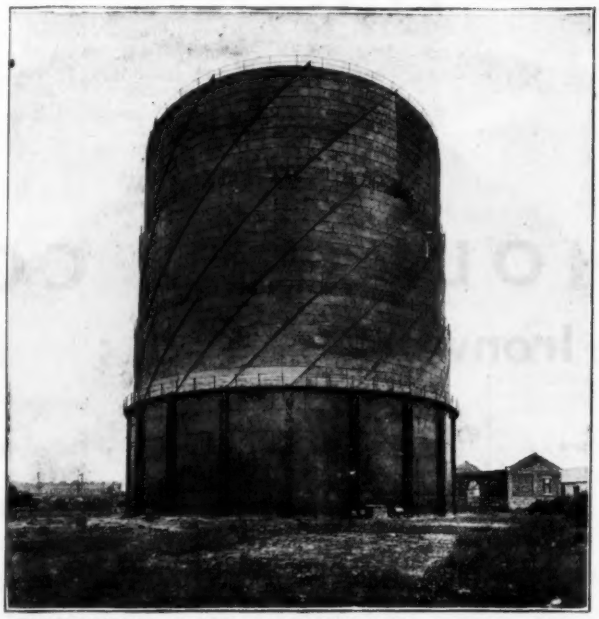

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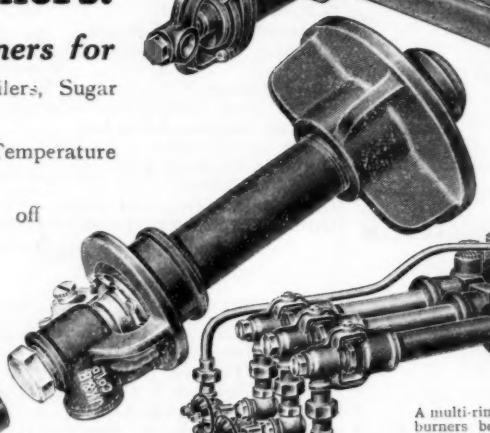

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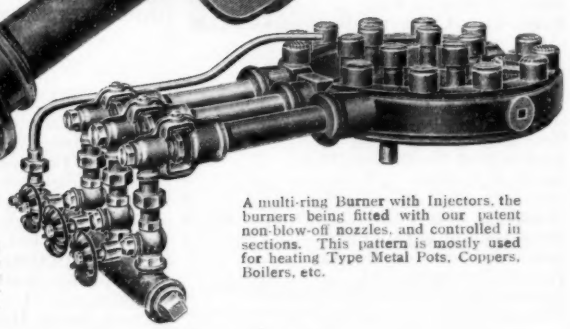

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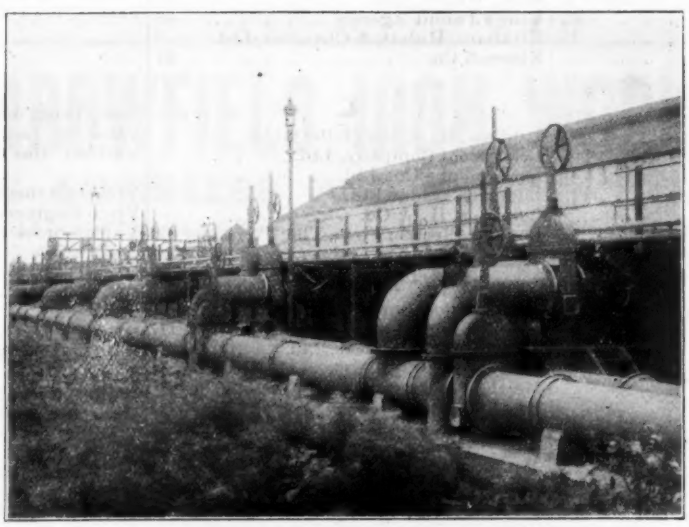

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